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Using video modeling to improve the social communication of an adolescent with autism spectrum disorder

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USING VIDEO MODELING TO IMPROVE THE SOCIAL COMMUNICATION OF AN ADOLESCENT WITH AUTISM SPECTRUM DISORDER

by

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"I think in pictures. Words are like a second language to me. I translate both spoken and written words into full-color movies, complete with sound, which run like a VCR tape in my head."

Temple Grandin
Thinking in pictures: And other reports from my life with autism

"At the age of nine years of age, I had a life-changing revelation. I figured out how to talk to other children. I suddenly realized that when a kid said, "Look at my Tonka truck," he expected an answer that made sense in the context of what he had said…..I never learned how to carry a conversation from talking to grown-ups, because they just adapted to whatever I said. Kids on the other hand, got mad or frustrated. How do normal kids figure this out? They learn it from seeing how other kids react to their words, something my brain is not wired to do"

John Elder Robinson
Look me in the eye: My life with Asperger's

"You don't learn to walk by following rules. You learn by doing and by falling over."

Richard Branson

"Conversation is a dialogue, not a monologue"

Truman Capote

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Abstract

Difficulty with many aspects of social interactions is a defining characteristic of Autism Spectrum Disorder (ASD). Video modeling (VM) has successfully improved a range of social skills for individuals with ASD in previous studies, but most often with simple social skills with young children. The current study used VMs scripted and recorded by peers to improve complex conversation and social gestures by a young adult with ASD. A multiple-probe, across-behaviors design found mixed evidence of experimental control of VM on the social behaviors of the individual with ASD, although all behaviors increased from baseline and generalized to other settings and conversants. Peer comparison data from the conversation partner suggest that the VM may have served to prompt the peer to guide and extend conversation as modeled in the VMs and that the conversation skills of the peer also improved throughout the study. Implications of the important role peers may play to enhance VM and improve social skills are explored.

Key Words: video modeling, autism spectrum disorder, adolescence, complex social skills, conversation, peer mediation

Public Abstract

Social interactions are very difficult for individuals with Autism Spectrum Disorder (ASD). Video modeling (VM) has improved a variety of social skills for those with ASD in previous studies, but most often for simple social skills in young children. This study used VMs created by peers to improve conversation and social gestures by a young adult with ASD. The study found some limited evidence of control by VM on the social behaviors of the individual with ASD, but all behaviors increased from baseline and generalized to other peers, settings, and unscripted words. Comparison data from the peer conversation partner suggest that the VM may have coached the peer to guide and extend conversation in ways modeled in the VMs and that the peer's conversation skills also improved. The role peers may play to enhance VM is discussed.

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Chapter 1: Introduction

In this chapter, I explore the challenges inherent to effective intervention of social skills for those with ASD and explore tensions between the characteristics of those with ASD and conceptual frameworks of social competence, social learning, and social interaction. I propose video modeling (VM) as an intervention that has been shown to improve the social communication of students with ASD and promote generalization to natural settings. Finally, I briefly review how VM has been previously studied with adolescents to teach complex social skills and explain how the current study can make a contribution to the existing knowledge base of VM and social skills for those with ASD.

One of the hallmark symptoms of Autism Spectrum Disorder (ASD) is difficulty with many aspects of social skills. The Diagnostic and Statistical Manual of Mental Disorders (American Psychological Association, 2013) describes the persistent deficits in social communication and social interaction in the first criteria of the definition. Specific deficits include difficulty with social emotional reciprocity such as failure to initiate conversations or respond to social interactions as well as nonverbal deficits such as understanding and using gestures in social interactions and restricted patterns of behavior and interests, all of which impair social interaction and relationships. Social difficulties for those with ASD are especially problematic in adolescence, when relationships and interactions with peers typically become more important relative to relationships with family or adults, yet these relationships and associated social norms also become more complex (Brown & Larson, 2009). Impaired social skills interfere with academic learning and the development of a supportive social network and can lead to anxiety and other mental health issues, insolation, and loneliness (Bauminger &

Kasari, 2000; Bellini, 2006; Bellini, Peters, Benner, & Hopf, 2007; Locke, Ishijima, Kasari, & London, 2010; Kotsopoulos 2008).

There are clear challenges in the complexity of social skill learning and the nature of ASD. Individuals with ASD often struggle with the most basic or molecular of social skills such as eye contact, greeting, or joint attention, but authentic social interactions require the combination and flexible deployment of both simple and complex skills. Social difficulties for those with ASD involve both verbal and nonverbal communication (Loveland, Landry, Hughes, Hall, & McEvoy, 1988), but natural conversation between nondisabled adolescents often includes varied verbal skills as well as gestures to reinforce or extend verbal meaning (Goldin-Meadow, 1999). Social interaction often requires improvisation rather than implementation of a predictable social rule or script (Bottema-Beutel, Park, & Kim, 2017). Yet by definition individuals with ASD are known to be more rigid and rule-bound in their thinking and have difficulty generalizing learning from one situation to another. Peers are a prime source of authentic interaction and arbiter of skill and acceptance for adolescents. Yet the atypical and limited social skills of those with ASD impairs peer relationships and limit interaction opportunities where such skills are best learned (Humphrey & Lewis, 2008; Bauminger & Kasari, 2000).

Theory on Social Skill Development

The term social skills is widely used in many professional disciplines and by the general public alike. It is a deceptively simple term, and yet there is no single definition that is universally accepted and it has been characterized as "among the most widely misunderstood and ill-defined of all psychological constructs" (Merrell & Gimpel, 1998, p. 3). While there are many competing definitions of social skills, most of these share an understanding that social skills lead

to effective and appropriate interactions with others, but differ in the extent and granularity of component parts and focus on individual inputs vs social outcomes (Segrin & Givertz, 2003). Successful social interaction requires many component verbal and nonverbal behaviors, traits, abilities, and skills brought together in meaningful combinations appropriate for a specific context, situation, and culture.

In the fields of education and psychology, one of the most prominent conceptual and assessment models of social skills and social competence comes from the work of Gresham (1986; Gresham & Reschley, 1987; Elliott, Gresham, Frank, & Beddow, 2008). As Figure 1 illustrates, their model conceptualized social competence as the larger, umbrella concept but included three component parts: Social skills, adaptive behavior, and peer acceptance. Social skills included the subcomponents of interpersonal skills (e.g., conversation skills and cooperative or play behaviors), self-related behaviors (e.g., expressing emotion or positive attitude toward self), and task-related behaviors (e.g., attending, joint attention, following directions). Social skills were understood as including hundreds of component skills ranging in granularity and complexity. In addition to social skills, adaptive behavior of individuals was understood to contribute to social competence, including independent functioning, physical development, language development, and academic competencies. Furthermore, this model recognized peer acceptance as necessary in addition to individual performance in the other two components to result in overall social competence. Specifically, it mentioned the importance of grounding interventions within a socially valid, peer context to promote peer acceptance.

Interventions to improve social skills must therefore reflect the conceptual complexity involved in that pursuit. To result in meaningful outcomes, smaller discrete skills must be flexibly combined into more complex ones and larger skill domains. For example, the complex

social skill of conversation requires skills such as joint attention, greeting, turn-taking, initiating topics, maintaining topics, gestures, eye gaze, facial expressions, posture and orientation and many other pragmatic skills. In addition, successful outcomes require the social validation and acceptance of peers and other significant players including teachers and parents. Doing so would require the generalization of social skill learning from the intervention context to others such as new settings, with new people, with different materials, and in ways not explicitly modeled or scripted. A conceptual frameworks on programming for generalized outcomes is well established (Stokes & Baer, 1977; Stokes & Osnes, 1989) and should also be applied in the pursuit of social skill intervention.

Theoretical Framework for Intervention: Social Learning Theory and Enacted Practice

Bandura's social learning theory (1986) explains how behaviors like social skills are typically learned through observation of and modeling by others. As we observe others, we learn new behaviors and the rules surrounding behavior, and we use this information to guide future actions. Bandura also noted that many subprocesses govern observational learning, including attentional processes, retention processes, production processes, and motivational processes. The observer must be able to attend to, perceive, understand a model and to find it functionally valuable. The observer must have the cognitive and physical skills to retain and reproduce the model, and must be motivated to do so. Thus, the most powerful models are those most functionally relevant, most tailored to the skills of the observer, and most likely to be naturally incentivized. For those with ASD, however, natural social learning in-situ is often impaired or interrupted by inattention to key elements of social interaction (Bushwick, 2001; Klin, Jones, Schultz & Volkmar, 2003). Therefore, social skills interventions for those with ASD must include additional scaffolds to clarify the social learning process.

A related body of literature on social interaction and enactment suggests that social learning is further moderated by the social context in which intervention occurs (DeJaegher, DiPaolo, & Gallagher, 2010; Cuffari, 2014). Enacted social interaction theory suggests that social skill intervention procedures must incorporate holistic practice in flexible and unpredictable coordination of physical, verbal, and nonverbal social actions with those of others and that cognitive understanding follows from the actions of the collaborative construction and participatory sense-making in the social interaction not the other way around. Operationalizing this model means that social skill interventions should be situated in natural, authentic, enacted contexts such as conversation or activity groups with peers and focused on situationally-nuanced norms over universal rules (Bottema-Beutel et al., 2017; Carter et al., 2014; Wolfberg, Bottema-Beutel, & DeWitt, 2012; Ochs, Kremer-Sadlik, Sirota, & Solomon, 2004). Specifically, interventions should have scaffolding and support to teach social skills with flexibility and minimum artificiality and rigidity.

Video Modeling to Support Youth with ASD

One type of intervention, video modeling (VM) is grounded within natural settings that may lend itself to teaching with sufficient flexibility and authenticity. It is a strategy that has been described as effective, efficient, and flexible, using strengths common to many with ASD to teach social, academic, and life skills (Wong, et al., 2014; Bellini & Akullian, 2007; National Research Council, 2001; Reichow & Volkmar, 2010; and Simpson, 2005). Video modeling has been successfully used to demonstrate a wide variety of responses for youth with ASD and non-ASD disabilities, however VM has primarily targeted either social skills or functional skills for youth with ASD (Bellini & Akullian, 2007; Ayres & Langone, 2005).

Video models are short, recorded, edited videos that demonstrate behaviors in context using peer, adult, or self-models. The behaviors might be in the repertoire of a participant but not at the desired frequency, duration, or latency; or might be a new response not yet demonstrated by the participant. This intervention plays to the visual processing strengths of individuals with ASD, while also focusing their attention on the most relevant stimuli of a behavior, and can be replayed for efficient practice. Viewing a VM prior to an opportunity to demonstrate the skill thus primes the student with a clear and specific model of expected performance and natural contingencies that reinforce the skill (Plavnick & Ferreri, 2011). While the general efficacy of video modeling as an intervention for youth with ASD is fairly well-established, unanswered questions remain in several areas: (a) the use and effectiveness of VM with adolescents with ASD, (b) the application of VM to teach complex verbal and nonverbal skills such as conversation, (c) the degree to which VM interventions generalize, especially across stimuli to unscripted and unmodeled responses, and (d) the impact and potential mediating effects of the direct involvement of peers to develop and implement VM.

Adolescents and VM.

While VM has shown strong evidence of efficacy for youth with ASD, few studies to date have focused on adolescents and young adults with ASD (i.e., those age 13 or above), and only a handful of these targeted social communication skills (Plavnick, Sam, Hume, & Odom, 2013; Mason, Rispoli, Ganz, Bole, & Orr, 2012; Allen, Wallace, Renes, Bowen, & Burke, 2010). Studies involving preschoolers or early elementary years are far more common and additional research involving adolescents is a frequent recommendation in reviews of the literature (e.g., Shukla-Mehta, Miller, & Callahan, 2009, Wang & Spillane, 2009; Wang, Cui, & Parilla, 2011).

Complex conversation skills and VM. For typical adolescents and young adults, social competence requires skill in conversation and discussion (Turkstra, Ciccia, & Seaton, 2003). However, conversation skills remain a key and understudied focus for intervention. Conversation is a complex social skill requiring social awareness, coordination of affective and cognitive skills, and lengthy behavior chains of verbal and nonverbal skills (Waters & Sroufe, 1983). In addition, Elliott and Gresham (2007) have identified conversation turn taking itself as well as associated skills like listens to others, cooperates, and shows kindness among the top ten social skills valued by teachers.

The majority of VM studies with those with ASD focus on simple discrete skills practiced in isolation such as greetings (Williamson, Casey, & Siegel, & Buggey, 2013) or giving a compliment (Apple, Billingsley, & Schwartz, 2003), but VM has also been used with more complex social skills. VMs of short conversation scripts with multiple conversation turns have increased conversation following the scripts with some improvement in response variation and generalization (Charlop & Milstein, 1989; Charlop, Gilmore, & Chang, 2008). Improvements in verbalizations and conversation turns have also been noted as a secondary data source following VM intervention on three more discrete skills (Thiemann & Goldstein, 2001). In another study, therapist ratings of conversation, turn-taking, and nonverbal communication skills of college students with ASD increased following VM, but the study did not more directly measure changes in these behaviors (Mason, et al., 2012). While VM has shown some promise in teaching conversation and complex social interaction skills, questions remain regarding the degree to which VM teaches a generalized conversation skills versus a set of discrete and narrow responses with limited generalization to new stimuli.

Coordination of verbal and nonverbal skills and VM. Although social interaction normally includes both verbal and nonverbal communication, relatively few VM studies have targeted the pairing or coordination of verbal and nonverbal behaviors. Many of those that did so used the context of solo play actions and verbalizations rather than a context involving peer interaction or conversation (e.g., Boudreau & D'Entremont, 2010; Cardon & Wilcox, 2011; D'Ateno, Mangiapanello, & Taylor, 2003; MacDonald, Clark, Garrigan, & Vangala, 2005). Others focused only or primarily on nonverbal behavior isolated from verbal (Wilson, 2013; Kleeberger & Mirenda, 2010; Kroeger, Schultz, & Newsom, 2007).

However, VM has sometimes been used to teach more complex combinations of verbal and non-verbal social responses to stimuli, including a verbal, gestural response, appropriate facial expression, and vocal intonation (Charlop, Dennis, Carpenter, & Greenberg, 2010). While the coordination of four skill components is complex, each of these responses was simple and limited in the sense that they were short, highly structured, and elicited by adult experimenters in controlled settings with limited peer probes. Such results beg the question of whether VM can be equally as effective with longer, more natural, less structured, social interactions with peers.

Peers and VM. Peers are the source of many or most of the natural reinforcers in the adolescent social environment. Simpson, Myles, Sasso and Kamps (1997) argued that too often, adult-directed instruction of social skills fails to use the stimuli, vocabulary, and norms of the natural environment and result in invalid and ungeneralized results. ASD adolescents have rated the involvement of peers and the opportunity to interact with them informally in activities without adult direction as the highest-rated components of social interventions (Boettema-Beutel, Mullins, Harvey, Gustafson, & Carter, 2016).

VM studies have successfully incorporated peers in many ways, primarily as models in the VMs and peers for social skill practice during intervention, (e.g., Buggey, Hoomes, Sherberger, & Williams, 2009; Plavnick et al., 2013). Other studies used adults as models in the video, but used peers during the intervention itself. While early advocates of VM maintained that using a model as similar as possible was most effective, other studies have found that there was no difference in effectiveness or efficiency using an adult versus peer model (Sani-Bozkurt & Ozen, 2015) or self-model vs. other as model (Sherer, et al, 2001). However, direct peer involvement is necessary to identify preferred, reinforcing, activities that will trigger additional natural reinforcers in the environment, which are keys to VM effectiveness (Plavnick, McFarland, & Ferreri, 2014).

Very few VM studies have directly involved peers or participants in directing the development of a VM. Peers have indirectly contributed to VMs in studies that used observations of peers in natural settings to develop the content and targets skills for VMs (Sansosti & Powell-Smith, 2008; MacDonald, Sacramone, Mansfield, & Wiltz 2009; Buggey, Toombs, Gardener, & Cervetti, 1999), or the specific structure and syntax of compliments (Apple et al., 2005). In intervention probes, peers have been coached or prompted to initiate conversation scripts, to respond to initiations (Buggey et al., 2009; MacDonald et al., 2009; Sansosti & Powell-Smith, 2008;) or to provide direct feedback on performance (Thiemann & Goldstein, 2001).

Because social interaction is understood to be a shared co-construction between two people, the examination of peer data may be as important as data for the individual(s) with ASD. A few VM studies have incorporated the use of peer data for normative comparison of study outcomes and to demonstrate a parallel pattern in the data (Cardon & Wilcox, 2011; Sansosti & Powell-Smith, 2008; MacDonald et al., 2009). Social validity data has included a rating of peer

performance clips along with those of the focus student and found overall improvements for peers in drawing the focus student into the activity, responding to their communication, and asking questions (Thiemann & Goldstein, 2001). In the use of VM with complex reciprocal social exchanges like conversations, questions remain about the role peers can play in the intervention and their own possible need for modeling, practice, and ongoing experience in interaction to effectively engage with an unfamiliar partner they do not know well and whose social skills are limited.

Purpose of the Study

This study extends previous research on the efficacy of video modeling (VM) on the complex and varied verbal and gestural social communication skills of an adolescent with ASD in natural settings. The current study helps to fill in a gap in the VM literature with adolescents and may contribute to a deeper understanding of how VM can be effective with young adults as well as the nature of natural peer interactions for those with ASD at this age (Turkstra et al., 2003; Lord & Magill-Evans, 1995). Because of the primacy of peers in the social lives of adolescents and the associated adolescent variations in vocabulary, slang, syntax, conventions, and gestures, this study of modeling conversation skill will involve peers more directly than previous VM studies. Peers will direct the development of social conversation and gesture scripts and the filming, editing, and implementation of video models. The study will also analyze peer data for mediation effects and normative comparisons. Finally, the study examines the social validity of any changes in social conversation skills by the adolescent with ASD using ratings of conversation clips.

The study has four research questions. First, will VM result in an increase in the number of words and gestures used in conversation by the student with ASD and her peer? Second, will

VM result in increased use of unscripted words as well as those scripted in the model by the student with ASD and her peer? Third, will VM result in any changes in the number of verbal initiations or responses by the participant with ASD and her peer? Finally, how will the peers and educators at the school rate the social validity of the goals, procedures, and outcomes of VM?

Chapter 2: Review of the Literature

Introduction

In Chapter 1, I outlined the many challenges of identifying effective interventions to support those with ASD to learn complex social skills. I situated these challenges within the conceptual frameworks of social competence and social learning and proposed VM as an intervention well suited for teaching flexible social skill use within a natural setting. In this chapter, I will more explicitly define the problem to be addressed in this study and examine the VM literature that have targeted complex social skills. In particular, special attention is given to studies that intervened and measured for generalized outcomes and involved peers as part of the intervention. These strands of the literature inform the design of the study outlined in the next chapter.

Definition of the Problem

The primary defining characteristic of individuals with Autism Spectrum Disorder is difficulty with social interaction, yet effective social interaction is enormously complex to define and to master and critically important for success in school and life. Diagnostic criteria of ASD specifically refer to difficulties with initiating or responding to social interaction from others, reciprocal conversation, and the use of gestures and other nonverbal skills to communicate. Individuals with severe forms of ASD may not communicate verbally at all, while others on the higher end of the spectrum may have extensive verbal vocabularies but may perseverate on special interest areas, monopolize rather than share reciprocal conversations, or have difficulty integrating nonverbal expressions or gestures or initiating social interactions with peers (Ochs et al., 2004; Stribling, Rae, & Dickerson, 2009).

While impaired social skills are difficult on their own, they may also set off a domino effect of negative outcomes in other areas. Difficulty with social skills in early school years can

be compounded when they lead to social rebuffs by peers, denying those with ASD the opportunity to experience and learn normative peer social culture. Even worse, naivety or lack of social skills make students with ASD a target for teasing and bullying at school (Humphrey & Lewis, 2008). Social isolation or rejection is especially problematic in adolescence, when peer relationships become more important than those with family, and the social mores and expectations are more complicated (Brown & Larson, 2009). Even when children with ASD report having a friend, they report more intense and frequent feelings of loneliness than typical peers (Bauminger & Kasari, 2000). Social skill deficits have also been linked to an increase in mental health issues (Bellini, 2006; Bellini, Peters, Benner, & Hopf, 2007; and Ratcliffe, Wong, Dossetor & Hayes, 2015), impaired academic learning (Kotsopoulos, 2008) as well as negative adult outcomes in employment and independent living (Howlin, Mawhood, & Rutter, 2000).

Successful social interaction is complex endeavor. It requires the flexible deployment and synthesis of a broad range of social communication skills adapted for the culture of the context. Simple, molecular social skills such as eye contact, saying hello, or responding to a question are often difficult for those with ASD, even in isolation, but fluent social functioning often requires such skills to be chained or combined simultaneously. Complex social skills such as conversation require an even longer and more complicated set of verbal and non-verbal skills and pragmatic understanding of conversation norms like taking turns or repairing a miscommunication. Successful social interaction also requires generalizing and adapting skills depending on context-specific norms related to age, gender, culture, setting and other factors (Waters & Sroufe, 1983)

The school environment requires a diverse array of social skills. (Boettema-Beutel, 2017; Carter et al., 2014; Ochs et al., 2004). When students walk in the school door, there are immediate social expectations for greeting peers and teachers verbally and/or nonverbally paired

with an expectation that greetings and responses will differ based on factors like authority, relationship, shared experiences, and interests. In the classroom, teachers expect students to answer questions, volunteer responses, contribute to class discussions, and to participate in solving problems in collaborative small groups or partners (O'Brien & Wood, 2011; O'Brien & Dieker, 2008). Teachers expect that students can read verbal and nonverbal cues to pay attention or to get back on task. In conversations, peers often use unique slang variations, gestures, or intonation as they communicate with each other that can seem a completely foreign language to adults. Engaging meaningfully with peers requires reciprocal conversation skills, 'reading' a social situation, making verbalizations and/or gestures and to determine appropriate responses and initiations such as offering to help, joining in to an activity, answering a teacher's or peer's question or participating in group discussions in the classroom or at the lunch table (Turkstra et al., 2003).

Complex social communication skills such as conversations and coordinating verbalizations and gestures to communicate meaning are foundational to basic social interaction and the development of peer relationships but are also those of greatest challenge for adolescents with ASD. Youth with ASD may avoid conversations with peers (Lord & Magill-Evans, 1995; Orsmond, Krauss, & Seltzer, 2004; Orsmond & Kuo, 2011) or show limited initiations, responses, and gestures (Loveland et al., 1988), and show difficulty with reciprocal turn-taking and avoiding perseveration on particular topics (Ochs et al., 2004). Social difficulty often leads to less peer interaction and less opportunity to practice and develop social skills, leading to further social impairment. Limited time spent in conversations with peers correlates to further future social impairments as well as negative maladaptive behaviors (Orsmond & Kuo, 2011).

Successful social interactions also require the complex coordination of nonverbal social skills. Nonverbal gestures can substitute for or reinforce words and meaning and gestures as a phenomenon are found across ages and cultures (Goldin-Meadow, 1999). Gestures are associated with the development of language in typically-developing children and are used to supplement and support verbal communication later on (Buffington, Krantz, McClannahan, & Poulson, 1998). However, youth with ASD use gestures far less often in social settings than typical peers (Attwood, Firth, & Hermelin, 1988). Some have hypothesized that language deficits in those with ASD are related to a wider system of limitations in gestures, attention, and imitation (Bates & Dick, 2002). Therefore, intervention should focus on both verbal and nonverbal forms of social communication.

Video Modeling

Fortunately, Video Modeling (VM) has emerged as an effective practice for teaching a wide range of skills, including social skills, to youth with ASD. In the creation of self-models, hidden supports such as prompts or scripts necessary to evoke the responses are edited out, so that the finished product illustrates the target response in a perfected form. Dowrick (1999) further classifies types of self-modeling into the categories of *positive self-review* (modeling the best examples of the response demonstrated by the participant to shape and increase it) and *feedforward* (modeling a skill not yet acquired). The video models are then viewed prior to practice opportunities to remind and model the desired response(s).

Video models capitalize on the strengths of those with ASD including strong visual processing skills and strong interest in watching videos (Bellini & McConnell, 2010; Corbett & Abdullah, 2005). Further, the video models themselves "deluge the child with visual representations of personal success," especially when a self-model is used (Bellini and

McConnell, 2010, p. 221). The intervention allows for efficient repetition and practice, a tighter focus on the most relevant features to minimize the stimulus overselectivity common to those with ASD, and is effective for those with difficulty comprehending verbal or written cues (Corbett & Abdullah, 2005; Maione & Mirenda, 2005; Bellini & McConnell, 2010). There are several areas related to successful VM implementation that warrant further discussion (see below): (a) the complexity of social skills that are the target of intervention, (b) the age of the the participants in the VM studies, (c) peer involvement in VM development and implementation and (d) the impact of VM on unscripted/generalized outcomes.

Complex Social Interaction Skills and VM

Plavnick et al., (2013) define a basic social skill as "an isolated response to a specific stimulus, such as saying 'Hey' when a peer says 'Hi'" (p. 68). The VM literature includes many examples of teaching basic social skills such as greeting, asking a peer to play, waving and giving high fives (Allen, et al. 2010) or correctly answering a question (Buggey et al., 1999). Complex social interaction skills, however, require the combination of multiple responses that facilitate further interaction with another person. For example, if a student not only responds with a greeting but adds a follow up question or a request to play or adds a coordinating gesture and facial expression, the behavior becomes part of a chain that leads to more interaction and potentially to naturally occurring reinforcers (Plavnick et al., 2013).

In this review, two categories of complex social interaction skills were specifically sought: verbal conversations and the coordination of verbal and nonverbal behaviors to communicate meaning. Conversation is a highly complex social interaction that is especially important for social competence in adolescence (Gallagher, 1993 and Wiklund, 2016). Effective conversation requires verbal social initiations and responses, an understanding of the concept

reciprocity and turn-taking as well as maintaining topical relevance. To be included in this category, the definition of one dependent variable had to require both initiations and responses and a minimum of two turns of verbal interaction. Coordinating verbal and nonverbal communication behaviors in social interaction is a second category of complex social interaction skill reviewed. To be included in this category, the dependent variable(s) had to require at least one verbal behavior paired with at least one nonverbal behavior such as eye contact, facial expressions, gestures as part of social interaction. Because this study was focused on social skills that involve direct interaction with others, studies that included complex social skills but did not involve interaction with others such as pretend play with toys were not included.

Adolescents with ASD and VM

Adolescence is a stage of life that can be particularly tumultuous and challenging. The transition from childhood to adolescence is rooted in issues of identity and independence that both complicate peer relationships but also underscore their growing importance (Boettema-Beutel & Smith 2013). In adolescence, peer relationships become more important, but the norms and expectations of peer social interaction undergo great change, all of which present unique challenges to social skill development by those with ASD. The small number of studies of VM with adolescents raises questions about the efficacy of the intervention for this age group (Shukla-Mehta et al., 2009, Wang & Spillane, 2009). Wang et al. (2011) found that age was a significant predictor for effect size, with a smaller effect size found for the small number of VM studies with adolescents. In contrast, Bellini et al. (2007) in their meta-analysis of school-based social skills interventions of all types for students with ASD found that the highest percentage of non-overlapping data (PND) occurred in studies with secondary students compared to elementary or PreK, which suggests the opposite direction of difference in effectiveness related

to age. As the current study involved adolescents and young adults, this review identified the ages of the study participants to examine whether the gap of research with adolescents persists in the area of complex social skills research.

Peer Involvement and VM

Given the critical importance of peers in adolescence and their primacy in defining cultural norms for social interaction, this review examined the role peers played in the studies, especially in regard to the use of peers in defining or norming target behaviors and in validating results. Peer-Mediated Instruction (PMI) is also recognized as an Evidence-Based Practice for youth with ASD to address many areas including social, communication, play, school readiness and academic skills and include practices such as peer tutoring (Kamps, Barbetta, Leonard, & Delquadri, 1994; Laushey & Heflin, 2000; Petursdottir, McComas, McMaster, & Horner, 2007), peer networks (Kamps, Potucek, Lopez, Kravits, & Kemmerer, 1997), group contingencies (Kohler, Strain, Maretsky, & DeCesare, 1990), and other variations (Fettig, 2013; Strain, 1981). Reichow and Volkmar (2010) concluded that peer training should be considered a recommended practice in teaching social skills to youth with ASD. In addition, Carter et al. (2014) recommend that because the social culture of a secondary school is controlled primarily by peers, they should be involved at early stages of intervention to ensure the social validity of the strategy and targets.

Unscripted and Other Generalized Outcomes in VM Studies

Because effective social interaction requires generalizing and adapting skills to new settings, people, and situations, this review also analyzed the literature for the strategies used to program for generalization and further investigated studies with especially robust unscripted or generalized results. Generalization is defined as the demonstration of the target behavior in a setting or stimulus situation that was different from the training context and may include using

the behavior across settings, with different people, using different materials, or in the case of conversations across different topics. Generalization to unscripted behaviors is especially relevant to conversations because simply memorizing a specific conversation script has far less social utility than teaching general conversation skills of reciprocity and topic maintenance.

The importance of planning for and training for generalization is not new and was most influentially described by Stokes and Baer (1977) who categorized the generalization literature according to a lack of generalization planning (Train and Hope) or eight kinds of generalization training strategies. These were later conceptualized into twelve tactics in three main categories: (1) exploit current functional and naturally occurring contingencies, (2) train diversely with multiple exemplars and loose stimuli, and (3) incorporate functional mediators including common stimuli and self-mediation (Stokes & Osnes, 1989). While several previous reviews of the VM literature have reported studies that included generalized results, none included a specific analysis of the generalization tactics incorporated in the study or looked in particular for unscripted or unmodeled results.

Purpose of this Literature Review

While the efficacy of VM as an intervention for youth with ASD has been synthesized in more than twenty previous reviews, the general efficacy of VM of previous reviews re-examined how well the VM literature has addressed several specific issues including the complexity of skills targeted by VM studies, the use of VM with adolescents, the involvement of peers in VM studies, and generalization strategies and outcomes. As discussed in Chapter 1, the construct of social skills includes a broad range of skills and is not organized under a universally-recognized definition. The VM literature on social skills also includes a broad range of skills. Successful social interaction and competence requires not the isolated demonstration of a single, simple

social skill, but rather the flexible combination and synthesis of many skills, adapted to a particular context and co-constructed with another person. Therefore, this review identified and analyzed studies that applied VM to improving complex social interaction skills of youth with ASD. In doing so, studies were closely scrutinized for the complexity of the social skills involved and the extent to which they result in unscripted, generalized results and investigated the role of peers as possible mediators, validators, and natural reinforcers.

Literature Review Procedures

The questions asked by this review are: (1) to what extent has VM been applied in teaching complex social interaction skills for youth or young adults with ASD, (2) what role did peers play in the studies, and (3) how have studies programmed for generalization and to what extent have these resulted in unscripted or generalized outcomes.

Several criteria were used to identify studies for this review. First, the study had to employ an empirical design and appear in English in a peer-reviewed journal. Second, the study had to include at least one subject with ASD. Third, the intervention used in the study had to include video modeling as a primary independent variable. Studies that added other interventions to VM such as Social Stories, prompts, reinforcement, or peer mediation were included but the additional intervention components are discussed as limitations. Fourth, the dependent variable and focus of the VM study had to be a complex social interaction skill as defined above.

ERIC, Education Full Text (EBSCO), PsychINFO, and Google Scholar were used to systematically search for studies using keyword search terms of video model, video self-model, autism, ASD, social skills, play, conversation, social interaction, communication, and gesture. In addition, references from the existing reviews of the literature were also examined.

The total number of articles initially returned from variations of the search terms was very large. For example, searching for "video model" "autism" and "social skills" alone on Google Scholar yielded more than a thousand results. Many of the search criteria could be applied by reading only the abstract. For example, a large number of descriptive or practitioner-oriented articles that did not have an empirical design were excluded (e.g., Bellini & McConnell, 2014; Plavnick, 2012). Studies that targeted academic or functional living skills were excluded (e.g., Delano, 2007; Burton, Anderson, Prater, & Dyches, 2013; Hart & Whalon, 2012). However, a total of 65 studies that appeared to meet search criteria were read in their entirety to critically examine whether the inclusion criteria, especially regarding the complexity of the social skill targeted. From that group, a total of twenty studies met all inclusion criteria after thorough review including eleven studies of extended verbal interactions that included both initiations and responses (conversations, see Table 1) and nine of complex coordination of verbal and nonverbal communication (see Table 2). Studies from the initial group of 65 were excluded for a number of reasons. Fourteen studies were excluded because they targeted solo play skill that did not involve interacting with others such as learning to play a video game or solo play verbalizations and actions with a toy set. Ten studies were excluded because they targeted a verbal initiation only such as an invitation to play, compliment, or greeting without extending verbal interactions or addition of nonverbals.

Nine studies were excluded because the operational definition and data reporting made it impossible to ensure that the definition of complex social interaction skills were met. For example, Nikopoulos & Keenan (2003, 2004, 2007) used two variables of "latency to social initiation" and "reciprocal play." The definition of both behaviors counted any appropriate nonverbal or verbal behavior as correct and the data are not reported in a way that ensures that

both a verbal and nonverbal were demonstrated or both verbal initiations and responses. Bellini, Akullian, & Hopf (2007) used a single variable of "unprompted social engagement" that included verbal and nonverbal skills, initiations, responses, joint play with toys, and many other examples. However, since the data were reported only as the percentage of intervals in which any one of these might have occurred. Thus, if a student played catch with a peer without speaking for at least part of each one-minute interval, the data could report 100% even though that behavior would not meet the inclusion definition of complex social interaction. The remaining studies were excluded because they targeted only a verbal response such as answering a question (n=2), targeted only nonverbal social skills (n=3), because the experimental design did not allow clear demonstration of control (n=5), or because a social interaction skill was not clearly targeted (n=2) but instead correctly labeling an emotion or folding a shirt.

Results

Table 1 displays summary information on the age of subjects, the complexity of the social interactions, the role of peers, efforts to program for generalization, and unscripted and other generalization results for the eleven studies that used VM to improve extended verbal interactions. Table 2 does the same for studies of VM to improve the coordination of verbal and nonverbal interactions. Additional details are reported in the narrative below.

Studies with adolescents and young adults. Of the twenty studies, only five involved at least one person aged 13-21, for a total of only twelve adolescents and young adults. While the results of all five of the studies were positive, there is still a clear need for additional VM research with adolescents, especially involving complex social interaction skills. One of the studies (Day-Watkins, Murray, & Connell, 2014) was a replication of a study that was originally

with much younger children (Reeve, Reeve, Townsend, & Poulson, 2007) and the results with the adolescents were not as strong as in the original study.

Interventions added to VM. Although the addition of other interventions to VM was not one of the original questions of this review, it became clear in the analysis that relatively few of the studies used VM alone, which raises the question of whether VM is powerful enough on its own to teach skills as complex as conversations and verbal/nonverbal coordination. In fact, several of the studies incorporated VM into a larger treatment package that make it impossible to ascertain the unique contribution of VM to the results and will be analyzed with caution below. Radley et al. (2014) studied the impact of the *Superheroes Social Skills* program that used both animated cartoon and peer video modeling in addition to comic books, direct instruction, role play, feedback, praise, self-monitoring. Thiemann and Goldstein (2001) used a package that included Social Stories, cue cards and verbal prompts, self-monitoring, and the use of peers as feedback mediators and the form of VM was video feedback, with the peers and participant viewing a recording of their daily interaction as they self-monitored their use of social skills and discussed together how they could improve.

Other studies found a need to supplement VM when it did not result in sufficient change on its own for one or more subject or baseline. Maione & Mirenda (2006) added verbal feedback and then prompting for one of the three baselines across playsets when the toys in that condition were so highly preferred that talking and interactive play became more of a challenge. Verbal prompts were added in four sessions for one of the baselines for one behavior (Litras, Moore, & Anderson, 2010). Teacher prompting of two of the participants as well as the peers was added to VM that were part of a Social Story when an initial improvement in the target behavior of joining in was not recognized and reinforced naturally by peers on the playground and

subsequently declined (Sansosti & Powell-Smith, 2008). Similarly, MacDonald et al. (2009) added peer coaching and prompting in four of the sessions when peers did not initiate the play script that had been modeled.

In other studies, VM was supplemented in more subtle ways. For example, in four studies the VM was implemented in a group setting in which included in-vivo modeling from other participants and peers (Mason et al., 2012; MacPhearson, et al., 2015) in addition to prefacing the VM with direct instruction on basic social skills rules (Plavnick et al., 2013; Plavnick et al., 2015). Tangible reinforcers, prompts, or feedback were used in addition to VM during the training phase of a number of studies (Day-Watkins et al., 2014; Tetrault & Lehman, 2010; Reeve et al., 2007; Gena, Couloura, & Kymiss, 2005; Taylor, Levin, & Jasper, 1999; Charlop & Milstein, 1989).

Of the twenty studies, only two clearly used video modeling as the sole intervention in all phases of the study (Kim, 2016; Sherer et al., 2001). While both studies reported strong results in some aspects (scripted verbalizations and play actions for Kim, three of the five participants for Sherer et. al), both had limited impact in others (unscripted verbalizations and play actions, two of five participants). Although the twenty studies as a group offered strong evidence for the effectiveness of VM with complex social skills, this is tempered by the supplementary interventions that may have been necessary to achieve the results.

Analysis of complexity of conversation. The eleven studies that met the criteria of targeting both initiations and responses and a minimum of two conversational turns included a range in terms of the complexity of the behaviors modeled in the videos and the granularity of the data collection and reported results that offer guidance for the current study. In terms of the complexity of the skills modeled in the video model, the most common approach was to create

multiple-turn scripts of verbal communication (Maione & Mirenda, 2006; Sherer et al, 2001; Taylor et al., 1999; Charlop & Milstein, 1989) sometimes paired with nonverbal actions such as eye contact (Tetrault & Lerman, 2010) or play actions with toys (Kim, 2016; MacDonald et al., 2009). However, some modeled extended scripts of more than a dozen verbal phrases and more than ten conversation turns (Kim, 2016; MacDonald et al, 2009; Maione & Mirenda, 2006) while others modeled much shorter phrases and only three conversation turns (Charlop & Milstein, 1989. In one case (Mason et al., 2012), the conversations in the video models were not scripted in advance and were instead examples of truly spontaneous and natural conversation, without describing details regarding turns or number of verbalizations.

In other cases, the VM focused on shorter, more discrete interactions (Plavnick et al., 2013), some of which do not meet the inclusion criteria for conversations but do meet the definition of complex verbal and nonverbal coordination below (e.g., inviting peers to join and activity, offering assistance). However, one of the behaviors was maintaining conversations and modeled responding to a comment or question and making a follow up question or comment to invite a response, which minimally meets the inclusion criteria.

Another factor that influenced understanding of the true complexity of the conversations was the granularity of the data collected, analyzed, and reported. Studies that collected frequencies of scripted and unscripted verbalizations (MacDonald et al., 2009), that coded verbalizations as initiations or responses, (Maione & Mirenda, 2006), and measured the length of reciprocal verbal chains (MacDonald et al, 2009) or multiple-turn interactions (Thiemann & Goldstein, 2001) allowed for a more nuanced analysis and understanding of conversation and revealed more complex results than other data collection approaches. For example, when reporting conversations as a percent of time intervals observed (Sansosti & Powell-Smith, 2008),

one can see that talking is occurring more often, but not any measure of variety or reciprocity or assertiveness. When reporting conversations as a percentage of discrete trials correct (Plavnick et al., 2013), one can see that accuracy of a two-turn conversation has increased in contrived practice situations, but not an impact on longer turns or variety of conversation in less structured contexts. When reporting conversation elements like turn taking and sharing emotions in terms of a Likert-scale rating by an observer (Mason et al., 2012), one can see that an indirect quality rating has increased, but not what that means in terms of the direct quantity and variety of turns.

The current study thus aimed to create naturalistic conversation scripts and video models that demonstrate many turns of conversation, longer sentences, and a variety of content (compliments, invitations, observations). In addition, the data were collected to allow an analysis of the quantity scripted and unscripted words as well as initiations and responses.

Analysis of complexity of verbal and nonverbal coordination. In studies of verbal and nonverbal coordination, there were generally two categories of approaches. One group of studies targeted the coordination of a verbal communicative statement and nonverbal action that made sense in the context of the situation and statement. For example, two studies used VM to teach complex helping skills (Reeve et al., 2007 and Day-Watkins et al., 2014). Participants had to discriminate between situations in which help is needed and those where it was not, then to approach to make a verbal offer to help followed by the relevant helping action (e.g., finding a lost water bottle, carrying toys, passing out juice boxes). Other studies defined a social initiation or response in ways that required coordination of a verbalization with other nonverbal such as approach, body posture or stance, and head nodding or pointing (Plavnick et al., 2015; Radley et al., 2014).

Another group of studies targeted the coordination of one or more nonverbal skills that are intended as a communicative response or supplement to a given verbal communication. The most complex example of this type is making a statement like "That's cool!" and coordinating it with an exclamatory vocal intonation, a gesture of hands up/palms out, and a facial expression with raised eyebrows (Charlop et al., 2010) and met criterion in all four of the behaviors for all participants. In contrast, Scattone (2008) targeted verbal initiations, eyes contact, and smiling, but results for smiling were very limited. Further, although Gena, et al. (2005) modeled and practiced three coordinating nonverbal behaviors (eye contact, facial expression, and gestures) with a verbal statement in the videos, they did not target or report data for gestures as part of their design, which suggests a lack of VM impact on gestures. That question is reinforced by a study that modeled the coordination of a verbal compliment with a gesture (Macpherson, Charlop, & Miltenberger, 2015) and reported strong results in percent of verbal behavior and variety but much more limited and inconsistent results with gestures. The study used an unstructured, natural setting of a kickball game with other participants with ASD and typical peers in contrast to the structured individual practice of Charlop et al., 2010) and the authors believed that environment and peer responses may not have reinforced the use of gestures. The implication for the current study was a need for further study on the use of VM with gestures, and to involve peers directly in identifying appropriate and functional gestures that are most likely to be reinforced by the natural environment and other peers.

Role of peers. The most common role that peers played in the studies were as models in the video model itself (n=11) or as activity partners during intervention (n=10). Three of the studies explicitly prepared or coached the peers either prior to or during the study. Two of the studies collected and reported peer data to compare to the data for the participants with ASD and

two used observations of peers to identify normative examples of their independent variable of helping skills. One of the studies did not involve peers in any way (Kim, 2016, focused on social play with mothers and fathers) and another (Scattone, 2008), used peers as activity partners only in a single generalization probe).

There did not appear to be a correlation between a more intensive use of peers in the study and more robust results. One study used peers in five distinct roles, the most intensive use of peers in this group of studies. Thiemann and Goldstein (2001) matched a pair of peers to each of five children with ASD and explicitly prepared the peers to interact effectively by giving them a notebook of instructions regarding "How You Can Talk to Your Friends" during an orientation session. Peers were present during direct instruction via Social Stories on four primary social skills, and served as mediators by providing assistance in reading or answering the comprehension questions when needed. Peers served as activity partners during a social interaction period that was video-recorded. Finally, the peers and participants viewed the recording of their social interaction together (peers as models in the video), and peers were asked to give verbal feedback to the participant on his/her use of the target behaviors. The differential impact of either peers or the video model is muddied by the inclusion of multiple interventions in this package including Social Stories, prompting, feedback, reinforcement, peer mediation, and self-monitoring. While there were some clear improvements in the frequency of the four social skills demonstrated in the ten-minute activity, these results were far from robust. Experimental control was only demonstrated for three of the skills in three of the students and in two of the skills for the other two. However, additional data was reported on an improvement in topic maintenance skills as measured by an increase in the number of utterances per conversations. No effect size, IRD, PND, or other measure of impact was reported. Another study (Sansosti &

Powell-Smith, 2008), which used peers in four roles reported variable results, although the strongest were for the student whose target skill was maintaining conversations, who improved to a level that matched the peer comparison data.

In addition to Thiemann and Goldstein, two other VM studies prepared or coached peers, but in each case it was done after the study began when researchers noted that peers were not demonstrating the social skills needed to naturally reinforce or prompt improvements for the participants. While that underscores the importance of peers in social interaction, it also raises questions about authenticity and peer social validity of the social skills demonstrated by the individual with ASD or performances expected of the peer. In one study, (Sansosti & Powell-Smith, 2008), the participant with ASD was successfully initiating interactions, but these were ignored by peers, and as the initiations were not being reinforced they began to decline. Teachers in the study coached the other peers to respond to initiations. In the other study, (MacDonald, et al., 2009), peers needed to be coached to follow the conversation play script they saw demonstrated in the video model, which resulted in an immediate increase in the number of scripted actions and verbalizations by both the peers and the participants with ASD. The data in this study for the peer and participant are displayed side by side and, especially with the addition of peer coaching, seem to suggest that peers mediate the effect of the video model. Since the presence of peers as activity partners in intervention is a common feature of VM studies, but the collection of data on peer behavior that may impact or mediate the impact of VM is rare, this study will collect peer data both for normative comparison and to examine the possible impact of peer mediation.

Strategies to program for generalization. The most common generalization strategy utilized in the identified studies was to use common and preferred stimuli such as toys and games

to provide salient stimuli to elicit social interaction and conversation (n=15) and access to the preferred activities provided a natural reinforcer. The second most common strategy was multiple exemplars of VMs (n=13). The studies varied in the extent to which they controlled or structured the antecedent and consequences in intervention sessions (i.e., the degree to which they trained loosely). In some studies, the design required repeated structured opportunities that were artificially created with direct manipulation of antecedents and consequences. For example, Plavnick et al (2013) used a group instruction structure in which each participant was given a turn that included five to seven opportunities to demonstrate target behaviors like asking a peer to play or asking about the interests of others. Each behavior had clearly defined and contrived antecedents and thus the skills were practiced in isolation and not in unstructured, naturally occurring situations with more unpredictable antecedents. In other studies, such contrived discrete trials were created and applied, but only during training sessions until a criterion response was reached and then probe sessions were natural contexts without manipulation (e.g., Charlop & Milstein, 1989, MacDonald et al., 2009). A few of the studies, used loosely structured or unstructured interactions in all phases of the study. Two of the studies that utilized this loose approach resulted in the most robust results for unscripted responses (Maione & Mirenda, 2006 and Macpherson et al., 2015) discussed further below.

Unscripted verbalizations and other generalized outcomes. Nearly all of the studies looked for some form of generalization in the results, but three did not (Mason et al., 2016; Plavnick et al., 2013; and Scattone, 2008). Two others looked for generalized results and found no generalization results (Sherer et al, 2001) or very limited or inconsistent ones (Kim, 2016; MacDonald et al., 2009; Sansosti & Powell-Smith, 2008; Thiemann & Goldstein, 2001). The most common measure of generalization for the conversation studies was unscripted

verbalizations (n= 4), while the most common generalization reported for the studies of verbal and nonverbal communication were setting generalization (n=6) and stimuli (n=6) such as across play sets or toys or across helping situations.

A close examination of studies reporting the largest improvement in unscripted conversation is instructive to inform the design of the current study in very preliminary ways. Most notably, in one study, the robust results for several of the participants included no scripted responses, only unscripted ones (Macpherson et al., 2015). Similarly, another study (Maione & Mirenda, 2006) reported a higher increase in unscripted play comments than scripted. Like many of the other studies, these two both used common natural stimuli (a kickball game and the participants toys in the home) and access to these stimuli and peers were natural reinforcers in the environment. Contrary to many of the other studies reviewed, both of these employed a looser training procedure. While many of the other studies in this group used a repeated discrete trial approach for training and using contrived opportunities to reach a specified criterion of mastery before probing in more natural environments, these two introduced VM to unstructured environments of free play with toys and kickball, with no training or prompting for peers to contrive opportunities or act in a prescribed way. That approach made it more likely that the responses learned are those that are also naturally reinforced in the environment. However, it may have also suggested that the peers and other in-vivo factors of practice are playing more of a role than the video model. Both studies lacked data on peer and environmental factors to further examine that possible limitation.

Another factor that may have related to unscripted results is the behavior of the peer. Taylor, et al. (1999) demonstrated in a series of two studies a differential impact of VM under different conditions. The first study used a VM of short conversation with sibling and prompted

the sibling to say the scripted lines. This resulted in increase in scripted statements but no unscripted results. In a second study, a forward chaining process that gradually increased the length of the VM was used and the sibling was not instructed the script, resulting in an increase in spontaneous, unscripted play actions and comments. Contrast this to the limited generalization to unscripted verbalizations when the peers were explicitly prompted to initiate and follow the script (MacDonald et al., 2009).

The preliminary implications for this study, which sought generalized results across settings and people as well as unscripted responses, were to incorporate natural stimuli and contingencies, but also incorporate loose training procedures to introduce VM. In addition, data on peer behaviors was useful in examining a possible mediating effect of peers on the effectiveness of VM. Finally, the instructions or prompts given to the peers in the study were carefully considered and recorded for their possible impact on results.

Chapter 3: Methodology

Introduction

This chapter describes the design for the current study, which was informed by findings and limitations of previous VM studies, the conceptual frameworks of social competence and social learning, and the characteristics of adolescents with ASD explored in Chapters 1 and 2. Because few previous studies have applied VM as an intervention for adolescents with ASD, the current study examined VM with a young adult with ASD and four of her peers. Because VM was often enhanced with multiple additional intervention components in previous studies, the current study used only VM and the natural reinforcement and mediation of conversation and activity with peers as the sole intervention. To allow for a more nuanced analysis of patterns of improvement, the data included an analysis of conversation type, gestures, interactions and responses, and scripted and unscripted conversation. To aid generalization, peers played a more direct role in the development of the VMs but received no coaching or prompting in the activity sessions, multiple exemplars VMs were developed, common craft activity stimuli were used, and activity sessions were loosely structured.

Participants

Screening procedures. Teachers were asked to nominate students with ASD who demonstrated difficulty with social conversation skills. One student with ASD was nominated to participate and completed the informed consent and assent process with her mother. Before selection for the study, the student completed ten trials of delayed imitation of actions with objects and ten trials of delayed matching of pictures to objects, identified as important prerequisite skills for VM effectiveness (MacDonald, Dickson, Martineau, & Ahearn, 2015). Delayed imitation of actions involved modeling an action with an everyday object such as

jingling a set of keys, removing the keys from view for five seconds, then asking Teri to repeat the action. Delayed matching of pictures to objects involved showing Teri a picture of an everyday object, waiting five seconds, then bringing out a tray of ten objects and asking her to choose the object that was shown on the card. Teri completed these tasks easily, with 100% accuracy, which recommended VM as an intervention with a higher probability of success.

Student with ASD. Teri was beginning her final semester of high school and was 20 years old when the study began. Teri was diagnosed with autism when she was four years old and received special education services throughout her school career. She spent more than 80% of her school day in self-contained special education classes. Her scores on a recent Weschler Adult Intelligence Scale, Fifth Edition (WAIS-V), placed her in the moderate to severe range of intellectual disability with a full-scale score of 47, a verbal comprehension score of 50, a working memory score of 53, a processing speed score of 50, and perceptual reasoning score of 65. There were no formal assessment data related to Terri's expressive or receptive communication and specific information regarding the goals, supports, and services in her IEP were not available.

During initial study organization meetings with the student, Teri greeted two of the peers without prompts, but otherwise made no verbal initiations in the conversation. She answered direct questions with one-word answers, usually yes or no. She made eye contact with the peers, smiled at appropriate times, but was mainly an observer, not participant in the conversation.

Peers. Four peers were nominated for the study based on their interest in enrichment experiences in service, teaching, counseling, or psychology. Sonia, Susannah, Melina, and Marlo were all high school seniors aged 17-18 with no identified disabilities. All of the peers had previously completed a cadet teaching experience in the special education classroom where the

study took place. Two of the peers worked directly with the participant in the cadet teaching experience and two of the peers knew the participant from a shared class (Choir). All of the peers were identified by the teacher as having excellent social skills, were involved in multiple extracurricular activities at school (e.g., dance team, drama, show choir) and all were accepted to study at a four-year university for the following year. The peers participated in different roles in the study. All of the peers assisted with the activity selection process. Three of the peers wrote conversation scripts and were models/actors in the videos that were recorded. Sonia was eventually chosen by Teri to be her main activity partner for all intervention phases. Susannah attended all activity sessions and collected treatment fidelity data and assisted with field notes.

Setting

The study took place at a high school in a suburban Midwestern city. The high school enrolled about 1100 students, about 12% of whom had an Individualized Education Plan (IEP). A self-contained special education classroom was the main setting for the study. The front half of the classroom included an academic area with eight individual desks facing a whiteboard and projection screen. The back half of the classroom included a private restroom and a life skills kitchen and laundry area with a long rectangular table. The table in the back of the room was where the planning and activity sessions of the study took place, with Teri seated on one side of the table and the peer on the other, facing each other. The video camera and tripod were two feet away. Susannah and I were seated to the right and left of the camera facing Teri and Sonia. Other students, teachers, and paraeducators were also often present in the classroom space, usually facing away from the study space participating in leisure activities such as games, drawing, or watching videos or sometimes completing academic tasks or assessments. Paraeducators

sometimes used the kitchen area near activity area during the study to wash their hands, microwave their lunch, and wash their dishes.

The study took place during a 30-minute flexible period of intervention and enrichment time during the school day called "Power Hour" (30 minutes for lunch is also included in this hour). During this period, students participate in remediation or enrichment activities, socialize with friends, and upperclassmen are allowed to leave campus. It was thus a very natural setting for social conversation and leisure activities. Generalization sessions of lunch conversation took place in a small lounge down the hall or in restaurants in the community.

Materials

The peers, the student, and I created a total of eight video models (VMs) of social conversations while completing the activity using a Canon Vixia digital camera to record, iMovie to edit the footage, and a MacBook Pro laptop to view the video models. The video models were short, averaging 109.25 seconds in length with a range of 87 seconds to 133 seconds. The VMs featured shots of the peer, the student, and point-of-view camera shots and included an opening title (e.g., *Teri and Marlo Make a Collage* and *Teri and Melina Hang Out and Talk*), a closing title (e.g., "*Good Job, Teri and Marlo")*, and opening and closing music. Four of the VMs modeled activity-specific conversation with two of these modeling the conversations enhanced with gestures. The other four VMs modeled general conversation with two of these modeling the conversations enhanced with gestures. The process for creating the videos is further detailed in the procedures section. Materials for the art activity included cardstock paper, scissors, magazines, and glue sticks.

Dependent Variables

There were six dependent variables in this study: (a) total number of words used by the participant and peer, (b) total number of gestures used by the participant and peer, (c) number of unique scripted words spoken by the participant, (d) number of unique unscripted words used by the participant, (e) number of verbal initiations made by the participant and peer, and (f) number of verbal responses made by the participant and peer.

Total words in activity-specific or general conversation. The total number of words used by the participant and peer were first categorized according to whether they were used for activity-specific conversations related to the collage-making activity (e.g., saying "purple ones" in response to "What color pictures should we look for today?") or general conversations (e.g., saying "yeah, purple dress" in response to "Do you have a prom dress yet?"). Therefore, a given word like purple or common words like yes or no could be counted as either activity-specific or general, depending on the context of the phrase or sentence. Common activity-specific conversations included joint selection of pictures, deciding where to place them in the collage, asking to share materials, and complimenting each other on the finished product. In the generalization probes during lunch, activity-specific conversation was defined as talk related to the food or cleaning up after eating. General conversations were defined as all talk that was not focused on making the collage or eating lunch. Common topics included hobbies, weekend activities, music, Prom, field trips, family, pets, favorite foods, and TV shows. Conversations often moved quickly from one type to another. For example, a conversation about the collage ("Teri, should I cut out this cat or the dog?") might pivot to general ("Do you have a dog?") and vice versa (Teri interjecting "sticky hands" while gluing down a picture in the middle of a general conversation about breakfast).

Number of gestures. The number of gestures were defined as the number of hand and arm movements that communicated conventional meaning or affect. Specific modeled gestures in the VMs were determined by three of the peers. Table 3 provides an operational definition for each gesture modeled in the videos. Gestures were not coded as modeled or unmodeled because nearly all of the gestures used by the participant and the peer were one of the modeled gestures.

Scripted and unscripted words. The number of unique scripted words were defined as words that were in one or more of the conversation scripts from the video models viewed by the participant and peers to date. Therefore, as new VMs were introduced, the list of scripted words increased. Variations on any of the scripted words (e.g., jumping vs. jump or yeah vs. yes) were counted as unscripted. Each unique word was counted only once to focus this measure on word variation, not repeated use. The number of unique, unscripted words were those that did not appear in any of the viewed conversation scripts. Previous studies have used the number of verbal phrases rather than words as the primary unit of analysis; however, the verbal phrases were often very short (one or two word) and varied in operational definitions applied, making comparisons difficult (e.g., Maione & Mirenda, 2006; MacDonald et al., 2009). For typical adolescents, conversation 'turns' and phrases were expected to be longer and more complex than those targeted in previous VM studies. Rather than parsing out increasingly complex rules for defining whether the total phrase was scripted or unscripted the unit of the word was used to quickly and unambiguously determined if each word appeared in a previously-viewed video model or not. Data on scripted and unscripted words were collected only for Teri, not for peers.

Initiations and responses. The number of verbal initiations and verbal responses follow the definitions of initiations and responses used by Thiemann and Goldstein (2001) and Maione and Mirenda (2006). Initiations were verbalizations that were not directly contingent on a

preceding verbalization by the peer. Initiations signaled a choice to extend the conversation and to drive it further forward. Initiations included questions, a new comment, a change in topic, a compliment, or a request for attention. Responses were verbalizations that were directly contingent on a preceding verbalization by the peer. Responses can be seen as expected, required, but more passive parts of conversation as they are the reaction to the initiation driver. Responses included answers to questions or agreeing/disagreeing with a comment.

Transcript Analysis. The written transcripts of the conversations allowed for some limited consideration of other measures of conversation, including the number of conversation turns made by Teri, the development of new topics of conversation, and the emergence of new conversation management strategies by Sonia.

Data Collection

All activity sessions were video recorded. After each session, I transcribed the conversation and tallied the dependent variables (i.e., total words, number of scripted words, number of unscripted words, number of initiations and number of responses for both the participant and the peer) and recorded and graphed these as either (a) activity-specific or (b) general. In addition, I and one of the peers (Susannah) took daily field notes during the VM production process and from the intervention phases regarding social skills not targeted in this study (e.g., eye contact, facial expression, intonation, etc.) or contextual factors that might impact conversation (e.g., an emotional outburst right before the session).

Inter-observer agreement. I was the primary data collector and coder in the study, but 32% (11 of the 34 sessions) were also independently coded by a university instructor who is also the parent of an adolescent with ASD and was trained to criterion with the operational definitions and observation protocols. The agreement process included (a) checking for accurate

transcription of the conversations, (b) independent coding of activity-specific, general, and gestural conversation, and (c) independent coding of initiations and responses. Inter-observer agreement was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100 (Kazdin, 2011). Eleven of the thirty-four sessions were independently coded. Total agreement across the eleven sessions ranged from a low of 91.11% to a high of 100% with an overall average of 97.59%.

Experimental Design

A multiple probe design across behaviors was used in the study (Kazdin, 2011). The single-subject research design is one of the most commonly utilized design in the field of special education, where individual variation is recognized and embraced and the wide range of differences within disabilities and other groups is understood (Mastropieri et al., 2009). Because one subject was recruited for this study, an across-behaviors design was selected to attempt a minimum of three demonstrations of experimental control as well as to examine and document a hypothesized increasing complexity in the social conversation topics and incorporation of gestures the addition of VM intervention. The three behaviors were (a) activity-specific conversation, (b) general conversation, and (c) use of gestures while participating in a game or activity. The design also included generalization probes across settings and activities during lunch period. Each behavior included baseline phases, staggered introduction of video modeling, fading of video modeling, and maintenance probes. In this design, the participant served as her own experimental control, allowing multiple opportunities to examine whether the introduction of VM results in a change in the dependent variables for each conversation behavior type for a unique individual.

Procedures

The study included seven phases: Activity selection, baseline, VM intervention on activity-specific conversation, VM intervention on activity-specific and general conversation, VM intervention on gesture-enhanced conversation, fading, and maintenance (see Table 4 for an overview). First, in the activity selection phase, I worked with peers, the mother, and the teacher to identify a socially-valid activity in which to situate the conversations. Second, baseline data was collected for all behaviors including a generalization probe for lunch conversation. Third, there was a recursive, staggered introduction of video self-model production, post-video-production probe, and introduction of VM intervention across behaviors. In the video self-model production phases, the peers created video self-models by writing scripts and recording videos with Teri, first for activity-specific conversation, then for general conversation, and last to enhance all conversations with gestures. Next, a post-video production return-to-baseline probe was collected to test for the impact on dependent variables by the video production process. In the intervention phases, I introduced video models for each conversation behavior, collected a generalization probe, and when data stabilized then the video self-model production, post-video-production probe, and intervention process was repeated for the next conversation behavior. Once the final intervention phase stabilized, the video models were faded back, followed by a ten-week maintenance probe. Social validity data was later selected from peers, teachers and paraeducators at the school regarding their perception and rating of any changes in communication skills. Table 4 and the following sections describe each phase.

Activity selection. To ensure selection of a natural, motivating, and age-appropriate game or activity, the participant, her mother, her teacher, and all four of the peers were directly involved in identifying an activity for intervention. Teri's mother identified a variety of leisure

activities and games her daughter preferred and regularly chose at home and Teri's special education teacher did the same for preferred leisure activities at school. Both were asked to avoid any suggested activities that might trigger perseveration or repetitive, socially unacceptable behaviors (to avoid issues encountered in Maione & Mirenda, 2006). An initial list of fifteen possible activities was further winnowed down by asking the four peers to confirm whether the top activities were generally age-appropriate and socially acceptable to them and thus most likely to give the participant access to new reinforcers, contingencies, or environments (Bosch & Fuqua, 2001). Of the given list, the peers eliminated several games as not age-appropriate (the card game UNO, playing PBS Kids video games, playing Jenga). Peers also eliminated games or activities in which ongoing conversation would be difficult or uncommon (shooting baskets, dancing, watching a movie). Following peer discussion, four activities were identified by peers and Teri as top contenders: (a) playing a simplified version of the card game King in the Corner, (b) doing a puzzle, (c) coloring in an adult coloring book, and (d) making a collage out of magazine pictures. To make the final selection of the activity, the four peers and Teri participated in each activity for eight minutes then discussed the activity and resulting conversation.

The peers and Teri had played the card game Kings in the Corner before and agreed that it was very enjoyable but that the pace of the game and strategy and thinking involved made it hard to include conversation, especially conversation not related to the game itself. During the game, none of the peers or Teri made any general conversation or made any gestures. All conversation was about rules of the game, reacting to another player's move, or commenting on the quality of your hand. While Teri was able to follow most of the rules of the game, she sometimes needed hints and help. During the puzzle activity, Teri's attention was completely

focused on the task itself and while the group finished the 77-piece puzzle easily and the peers engaged in a lot of both general and activity-specific conversation, Teri spoke only twice with one-word responses and only after the puzzle was complete. A similar pattern took place with the adult coloring book, with Teri's attention focused on completing her section and ignoring most of the conversation around her except when asked a direct question or when her section was completed.

With the collage activity, however, the peers noted that the task was more open-ended and less pre-determined with more opportunities to pause for conversation, many of which were prompted by the variety of items in the magazines used. Teri and the peers all talked the most during the collage activity and it was the only activity that included gestures other than pointing. At the end of the discussion, I asked Teri and Sonia which activity they would like to do for the study for the next few weeks. Teri answered first, pointing to the magazines. All four of the peers also agreed it was the best option as an enjoyable, age-appropriate activity that they participated in with their other friends and as an activity that would elicit natural conversation. It is important to note that the three activities I thought were most likely to be chosen where the ones most quickly dismissed by the peers as not appropriate, underscoring the importance of recruiting peer feedback instead of relying only on adult understanding of the adolescent social world.

Baseline. The participant was asked to select one of the peers as the main activity partner three times per week for the duration of the intervention to control for the variable of the peers' conversation skills. Teri chose Sonia to be the main activity partner. During the baseline condition, Sonia and Teri created a collage together with limited direction. As they entered the classroom, I greeted them and guided them to the activity space and materials including a small,

clip-on lavalier microphone worn by Teri. I told them that they had eight minutes to work on a collage together then sat next to the camera and pushed record. After eight minutes, I told them the time was up and thanked them for hanging out that day and began cleaning up the materials and putting them away. There was also one generalization probe collected during baseline for lunch conversation. When baseline data stabilized, the video model production process began for activity-specific conversation.

Video model production. The peers played an active role as directors of the video models. Two of the peers (Melina and Marlo) each created scripts for four types of video models: (a) activity-specific conversation without gestures, (b) general conversation without gestures, and (c) gesture-enhanced versions of each of the two types of conversations. A total of eight VMs were created: two activity-specific conversations without gestures, two activity-specific conversations enhanced with gestures, two general conversations without gestures, and two general conversations enhanced with gestures. The VMs with gestures used the same verbal scripts, but enhanced the spoken conversation by adding ten gestures to each VM. See Table 3 for operational definitions of gestures included in the VMs, Table 5 for one of the activity-specific conversation scripts with gestures, and Table 6 for one of the general conversation scripts with gestures.

The production of each type of VM was staggered sequentially with the production of activity-specific conversation videos occurring first, then general conversation videos, and finally gesture-enhanced videos. The staggered production was intended to control for possible impact on the dependent variables by the practice and prompting involved in the production process. Prior to introducing the viewing of the VM prior to the activity, another probe session was scheduled to measure possible impact of the production process.

A number of procedures similar to those used in other VM studies were followed to ground scripts in natural contexts and vocabulary (Apple et al., 2005; Litras et al., 2010). However, the peers in this study were far more involved in this process and were far more of the driving creative force behind the scripts and videos. First, the peers were given transcripts of all baseline conversations as well as a transcript of all four of the peers completing the activity and talking together with Teri before the study began. Second, I gave the peers a list of ideas generated by Teri's mother and special education teacher about her interests, hobbies, usual activities and routines, as well as favorite foods, songs, and movies. I asked the peers to use the transcripts as a starting point for writing conversation scripts and to incorporate the lists of Teri's interests from the mother and teacher as well as their own personality, vocabulary, and interests into the scripts. Finally, I emphasized that they should write the scripts to be conversations they could imagine having with other peers their age and to write Teri's 'lines' to be closer in length and complexity to their other peers than her actual past statements from the transcript or previous conversations.

In addition, I gave the peers specific guidelines to ensure general equivalence of scripts so that each would: (a) take no more than one or two minutes to naturally read (i.e., in the range of 150-200 total words), (b) include an equal number initiations and responses by both conversants, (c) include at least eight conversation 'turns', and (d) use only activity-specific phrases or only general phrases for those video types and to later add ten gestures to enhance each previous VM version, and (d) include conversation relevant to all stages of the game or activity (i.e., beginning, middle, end). The peers created drafts of their scripts independently, compared drafts with each other for feedback from each other, and then worked with me to ensure the scripts were roughly equivalent and met the guidelines. To the greatest extent

possible, I avoided unnecessary edits or revisions to preserve the voice of the peers themselves and their natural conversational language. See Table 5 for one of the activity-specific conversation scripts with gestures, written by Melina. See Table 6 for one of the general conversation scripts and gestures, written by Marlo and Susannah.

Once the scripts were finalized, Teri and one of the peers rehearsed reading through them several times. To make the video appear more natural, Teri's lines were put on cue cards that I held behind the peer's head, out of the camera shot. We recorded the script multiple times to capture the best performance and to allow flexible editing of footage. A final video model was then edited down from the best 'takes' as well as point-of-view shots of the developing collage. The first video production process took five sessions to record with editing occurring over spring break.

Post-video-production probes. The production of the videos, with self-as-model naturally involved practice, rehearsal, feedback, prompts, and cues for Teri, all of which are known as interventions in their own right that may result in learning and improved performance. Therefore, before introducing the video modeling intervention, a return-to-baseline conditions probe was collected to examine the extent of learning during the video production process.

Video model 1: Activity-specific conversation. In the activity-specific conversation intervention phase, the procedures of baseline continued with the exception of adding the viewing of activity-specific conversation video models before starting the activity. When Teri and Sonia entered the classroom, I greeted them and said, "Before we hang out, let's watch a few of your movies," then directed them to the laptop on the table where they watched the two video models for activity-specific conversations, rotated for order each session. After the viewing of the VMs, the procedures used in baseline to introduce the activity and bring it to a close after

eight minutes were followed. During the first intervention phase the other three peers also began writing scripts for general conversations and gestures to enhance the VMs, but Teri and Sonia were not involved in that part of the production process.

When the activity-specific conversation intervention phase data stabilized, production of the video models of general conversation began, this time taking only three sessions to record and a weekend to edit. Once the second set of VMs were complete, a post-video production probe was collected under baseline conditions followed by the introduction of the VM intervention on general conversation.

Video model 2: Activity-specific and general conversation. In the second intervention phase of both activity-specific and general conversation, Teri and Sonia continued to view two video models, one for each of the behaviors (i.e., one VM of activity-specific conversation and one VM of general conversation) with the videos and behaviors rotated and counterbalanced systematically to control for order effects. Procedures for introducing the video models and play activities remained the same. When the second intervention phase data stabilized, the production of the third video models commenced, followed by a post-video production probe, and introduction of the gestures intervention phase.

Video model 3: Gesture-enhanced conversations. For the final intervention on gesture-enhanced conversation phase, each peer used their original scripts for activity-specific and general conversations but enhanced them with the addition of ten natural gestures as well making minor updates or revisions to the scripts to make them more relevant or timely (e.g., discussing Prom rather than spring break). Only one session of recording and one weekend was needed to record and produce the gesture-enhanced VMs. In the gestures intervention phase, the participant and peer continued to view two VMs each session: one gesture-enhanced activity-specific

conversations, and one gesture-enhanced-general conversation, again rotated to include a variety of peer models and alternating in order between game-specific and general models.

Fading and maintenance probes. When intervention phase data stabilized, the VM intervention was faded back, first by showing only one video model of Teri's choice, then returning to baseline conditions of no video models. Due to the impending end of the school year, the fading was rather abrupt, occurring in only two sessions. Ten weeks after the last fading prompt, a maintenance and generalization probe was collected in another setting under baseline conditions.

Generalization probes. Although generalization probes were originally planned to occur weekly with Melina, Marlo, and Susannah rotating in for lunch conversations in a small lounge near the classroom or in an area restaurant, scheduling conflicts allowed only four generalization probes, one in baseline and one in each of the three intervention phases. In each generalization session, I said, "Today you get to have lunch and talk together" then moved a few feet away and started the camera. Peers were instructed prior to the session to talk about whatever they normally would, but to try to engage the participant in the conversation whenever possible. Two of the four generalization probes took place at school and two took place in an area restaurant on the way to a class field trip.

Social validity. Several aspects of the design addressed social validity a priori through the active involvement of the participant, peers, and parent(s) in terms of the social relevance and importance of the activities and production of the VMs. In addition, the use of peer comparison data throughout the study serves as a normative benchmark for social validity (MacDonald et al., 2009; Sansosti, & Powell-Smith, 2008).

After the close of the study, three of the peers completed a short focus group interview, and were asked the following questions: (a) What did you think about the process of creating the video models? (b) What did you think about watching the video models? (c) Did you think the video models helped Teri's conversation skills? and (d) Did creating or viewing the video models have any impact on your own conversation skills?

In addition, after the close of the study, eight secondary special education teachers and paraeducators viewed two conversation clips, one recorded during the first day of baseline and one recorded on the last day of the video modeling phase. The order of the clips was reversed for two groups of the educators, but it was clear from their comments that all of them recognized which clip was from baseline and which was post-intervention regardless of the order viewed. The teachers and paraeducators completed a short Likert-scale rating similar to that used by Charlop and Milstein (1989), rating the communication skills of the participants in each of the clips. The educators all knew the students in the study and four of them were present to observe parts of the study in progress. They rated the following statements for each clip on a five-point Likert scale: (a) the student with ASD shows an interest in the conversation, (b) the student with ASD shows an interest in activity, (c) the student with ASD participates in conversation, (d) the student with ASD appears to enjoy the conversation, (e) the peer appears to enjoy the conversation, and (f) there is balanced participation in the conversation between the student and the peer.

Treatment fidelity. One of the peers, Susannah, completed a treatment fidelity checklist for every session that included the following items: (a) I greeted/welcomed Teri and Sonia, (b) I said, "Before we hang out, let's watch a few of your movies" (c) The order and type of the VMs followed the rotation schedule, (d) Teri and Sonia watched one or two videos depending on the

phase of the study, (e) I said, “Now you are going to make a collage and chat,” (f) Teri and Sonia had eight minutes of activity, and (g) after eight minutes, I said “Time is up. Thanks for hanging out today.”

Chapter 4: Results

In this chapter, I share the results of each of the dependent variables of the study, starting with data on activity-specific conversation, general conversation, and gestures for both the student with ASD and her activity peer. These data are reported in a multiple-probe across-behaviors graph in Figures 2, 3, and 4 and in a table of means for the variables in each phase of the study in Table 7. Second, I report changes in the number of unique scripted and unscripted words with data reported in Figure 5 and a table of means for each phase in Table 8. Third, I report data on the number of initiations and responses for both the student with ASD and her activity peer in a graph in Figure 6 and a table of means for each phase in Table 9. Fourth, I report conversation turns, topics, and strategies from the transcripts. Finally, I report social validity ratings from special education teachers and paraeducators as well as the peers involved in the study in Table 10.

Activity-Specific Conversation, General Conversation, and Gestures

The total number of words for each conversation type and the number of gestures were the most important variables in terms of empirical control in this study's design. Figures 2 and 3 display the multiple baseline-across-conversation graphs for Teri and for Sonia. Table 7 displays the mean number of activity-specific conversation words, general conversation words, and gestures used by Teri in each phase of the study. Note that in contrast to the later discussion of scripted or unscripted words, the words reported here are not unique unrepeated words but a true total (i.e., every time the words 'the' 'yes' 'no' were used, they were counted). Additional narrative explanation follows.

Baseline. In the baseline condition, all of Teri's verbalizations were one word (e.g., yeah, paper**,** red) or two-word phrases (e.g., purple one, hands wash). In the first four sessions of

baseline, Teri averaged 11.25 activity-specific words, 4.75 general conversation words, and 1.75 gestures; low compared to 129 activity-specific words and 49.5 general conversation words for Sonia, but very close to her average of 1.5 gestures. For Teri, that was an average of only two total words per minute compared to about twenty-two total words per minute for peer Sonia. Qualitatively, Sonia described these sessions and "awkward" and "hard." Although there was a slight increasing trend in the last two baseline data points, I interpreted these as relatively stable and flat enough to meet the decision rule and we commenced with the production of video models of activity-specific conversation.

Video model 1: Activity-specific conversation. Each intervention phase included video production of the VM, a post production probe, and introduction of the new VMs in the activity sessions. The post-video-production probe measured the impact of the scripts and rehearsal involved in creating the video self-model and natural learning that occurred since the last baseline probe twenty-six calendar days earlier. The probe showed a marked increase in Teri's activity-specific speech, more than doubling the number of words to 28, with smaller increases in general conversation and gestures, demonstrating clear and significant improvements before VM viewing began.

Following the introduction of the VM of activity-specific conversation, increases in activity-specific words continued. As Table 7 displays, activity-specific words for Teri increased from 11.25 in baseline and 28 in the post-video-production probe to an average of 36.60 in the five sessions of this phase. While Teri's verbalizations continued to be short one- or two-word phrases, the number of conversation turns increased and the periods of silent work decreased. General conversation words also increased from an average of 4.75 in baseline to 13.00, but in four of the five sessions the number remained near baseline levels and below the post-video-

production probe. The average number of general words in this phase is skewed by an outlier session in which Teri answered Sonia's question about what was for lunch that day by reading word-for-word the daily lunch menu options posted on the wall, creating a spike in the general conversation data in this phase. Teri's use of gestures remained low in this phase, with an average of 3.2 per session, nearly all of which were pointing gestures. After meeting the decision rule for three data points of stable or increasing trends, activity sessions were paused and video production of general conversation video models began.

Video model 2: Activity-specific and general conversation. In contrast to the first post-video-production probe, the data from the session following video production of general conversation but prior to viewing the video models showed a decline in activity-specific words for Teri, although still above all of the first baseline level. Teri also had low levels of general conversation and gestures in this session, similar to the first baseline, indicating little impact of the video production process on general conversation.

In this phase of the study, each activity session was preceded by Teri and Sonia viewing two video models, one of activity-specific conversation and one of general conversation, both showing no gestures. Teri's general conversation words increased significantly from 13.00 to 29.44 words per session. Initially, that increase was paired with an overall decline in activity-related words although activity-specific speech remained above baseline levels and averaged 22.44 words per session (See Table 7). While the total number of words increased in this session, there was an inverse relationship in the sessions in terms of how many were activity-specific and how many were general. In other words, if Sonia and Teri talked more about the collage in the session, there was thus less time to talk about general topics and vice versa. This phase also marked the first time Teri consistently used full sentences in conversation (e.g., "I ate pizza for

dinner," day 58 other variation day 63, 68; "I ate peanut butter sandwich for breakfast," day 59; "Disneyland is fun," day 64; "Bless you, Jacque," day 63). She also spoke in turns longer than one or two words more often ("Hawkeye Community College," day 58; "The Doobie Brothers," day 59; "No, purple one," day 62; "Jack Russell Terrier," day 68). Teri's use of gestures, however, remained low, averaging 1.44 gestures per session. In this phase, there was a gradual increase in general conversation words, but the level of the increase overlapped with the outlier baseline highpoint, and while the overall trend was increasing, there were also variations that included declines. Nine sessions were necessary for the data to stabilize enough to move on to video production of gesture-enhanced video models.

Video model 3: Gesture-enhanced conversation. The video production process to add gestures to the existing video models took only one day of recording and a weekend to edit. The post-production probe demonstrated no impact from the rehearsal and recording of the video, with a decrease both activity-specific and general conversation words for Teri and a continued low use of gestures.

In the gesture-enhanced VM phase of the study, Teri and Sonia viewed two gesture-enhanced video models prior to the activity session, one of activity-specific conversation and one of general conversation. Each video model included ten gestures, only one of which (pointing) had been previously demonstrated by Teri in activity sessions with another two (waving and high five) demonstrated in previous generalization probes. Three gestures were developed specially by Melina, Marlo, and Susannah for words used most often by Sonia in previous sessions but never used by Teri (i.e., awesome, cool, and yummy/tasty). After viewing the gesture-enhanced VMs, there was an increase in the use of gestures by both Teri and Sonia (see Figure 4). Teri's average number of gestures for the phase was 7.33 and Sonia's was 6.67, the only time Teri's

total for any category was higher than Sonia's, or even near Sonia's levels. While a visual analysis of Figures 2 and 3 make the increase in gestures appear small and insignificant, a rescaled comparison in Figure 4 makes clearer the impact of VM on the use of gestures for both Teri and Sonia. After six sessions, the data stabilized enough to begin fading the video models.

Fading of VMs. Because all of the study participants were seniors, the school year ended more than a week before the rest of the school, and the schedule of fading was limited to only two sessions and therefore fairly abrupt. In the first session, one video model chosen by Teri was viewed prior to the session and in the second, no video models were viewed prior to activity. In the two sessions, levels of activity-specific and general conversation remained high, but use of gestures decreased but remained above baseline measures. Teri's average for activity-specific words was 38.5 and for general conversation words was 40.5, both her highest phase average. Teri's use of gestures, however, decreased to an average of 5.5, still well above baseline averages.

Generalization probes. Four generalization probes were collected during lunch conversation: one in baseline, one in Phase 1, one in Phase 2, and one in Phase 3. The first two sessions occurred in a small lounge room down the hall from the classroom. The last two occurred in area restaurants on the way to a class field trip. The conversation partners also varied, with Melina participating in the first and third session, Susannah in the second session, and Marlo in the final session. Thus, generalization was across conversation type, setting, and peers. For the lunch probes, activity-specific conversation was defined as conversation about lunch itself, including the food, the restaurant, preparing to eat or order the food, silverware or plates, cleaning up, as well as any conversation about the collages.

In the first generalization probe in baseline with Melina, Teri spoke very little, using only four general words, eleven activity-specific words, and used one gesture; similar to the activity sessions in baseline. The second generalization probe with Susannah was at the end of the activity-specific conversation phase and Teri used five gestures, similar to the number she was then using in the activity sessions, but higher than baseline. She used fewer activity-specific words compared to the activity session (17 words), but far more general words (83 words), more than six times the mean number of general words in Phase 1. However, it should also be noted that Susannah's use of general conversation words in this probe was also far higher than the number typically used by Sonia. Susannah's total of 685 general words was more than double the total number of words Sonia used in that phase. The conversation topic that elicited most of these words (Prom) was later incorporated into the conversation scripts and VMs for Phase 2.

In the third generalization probe, which occurred in an area restaurant with Melina and about 2/3rds of the way through Phase 2, Teri used only 14 activity-specific words, the lowest since baseline, and 30 general words, near the mean for Phase 2. However, Teri used 6 gestures, the highest number of any session to date, perhaps in response to Melina's use of 16 gestures, much higher than Sonia typically used, or perhaps because the noisy, busy restaurant made it more difficult to hear verbalizations and gestures more necessary to convey meaning.

The final lunch probe with Marlo in an area restaurant near the start of the gesture-enhanced conversation intervention phase, and Teri's use of activity-specific, general, and gestural conversation spiked significantly. In this probe Teri used 17 gestures, the highest number of any session and more than double the mean for that phase. More than half of these were gestures modeled in the VMs including the awesome gesture and waving. Teri also used 39 activity-specific words, the second-highest number to date. In addition, Teri used more general

conversation words than in any other session, more than four times the mean of the phase at 120 words. Again, however, it is important to note that peer Marlo used 471 general words, far more than Sonia did in this phase (ranging from 164-259), although Marlo's activity-specific words and gestures were very similar to Sonia's averages. Note that some of the generalization probes are not reported in Figure 1 because the y-axis scale needed to show them obscures all other data patterns.

Ten-week follow up. Ten weeks after that last session, Teri and Sonia met for summer collage session in a room at the local public library. The two had not seen each other since their graduation and neither had access to the video models, and none of the VMs were viewed at the session. Despite the elapsed time, lack of practice, and absence of the video models, Teri's number general conversation words remained high at 37, higher than all phase means except for fading and generalization. Her use of activity-specific words had decreased to 17, still above the baseline level of 11.25, but less than half the average number of words she used in the activity-specific conversation intervention phase. Teri's use of gestures, however, the behavior in which VM intervention was introduced last and for the smallest number of sessions, had decreased back to baseline level, with only one pointing gesture used.

Scripted and Unscripted Words

Although the primary variables in this study's empirical design were the total number of words and gestures used in each conversation type, additional variables were analyzed to further examine interaction patterns and to measure generalization of conversation used by Teri in the study. The first of these was an analysis of whether the words used had been scripted in the video models viewed to that point. Because each unique word was counted only once, this count functioned as a measure of variation and generalization. Table 8 displays the mean number of

total unique words, as well as the means for unique scripted and unscripted words for each phase of the study and Figure 4 shows the data for baseline and intervention sessions in graph format.

There were 146 unique words in the two activity-specific video models and an additional 117 unique words in the two general conversation video models for a total of 263 scripted words by the second intervention phase of the study. Small revisions to the scripts when adding gestures resulted in an additional 16 scripted words by the gesture-enhanced conversation phase of the study for a total of 279 words. Scripted words included generally common words like yes, no, this, that, so, see, hi; as well as words directly related to the activity such as magazine, scissors, glue, and color words.

Baseline. In the baseline condition, all words were unscripted because the video models had not been scripted or created. Teri used an average of 14.60 unscripted words in baseline. The post-video-production probe was included in baseline because the VM had not been introduced or viewed, and this probe included the highest number of unscripted words at 26. While the first four baseline points included only common words (color words, yes, no, yeah, yay, good, one, and mom) words related to the activity (cut it, done, wash hands, upside down, tape), the post-video-production probe included new unscripted elements like saying thank you, bless you, and you're welcome and new words related to showing collage work ("Ta-da").

Video model 1: Activity-specific conversation. In the first intervention phase, Teri increased her average number of total unique, unrepeated words to 31.20, more than doubling the average for baseline. In this phase and all the ones to follow, Teri's average number of unique unscripted words (19.60) was nearly twice the average number of unique scripted words (11.0). New conversation topics that were introduced in this phase also elicited new unscripted words, see later section for more details.

Video model 2: Activity-specific and general conversation. Teri's use of unscripted words continued to increase in the second intervention phase. Her total number of unique unrepeated word in this phase rose to 34.33, with an average of 22.78 for unique unscripted and 11.55 for unique scripted. Teri's unscripted words were primarily elicited by contextual factors within the social interaction. For example, the context of the activity itself evoked words to name the item in a picture she cut out for the collage, to exclaim when she dropped a picture or got a paper cut, or to show off an item ("Ta-da"). The context of the classroom generated some unscripted words like naming a song playing in the background ("Eye of the Tiger") or saying "Bless you" when someone sneezed. Finally, unscripted words were elicited by answering Sonia's questions on topics that hadn't been scripted (some of these were written into later scripts) such as the names of people in Teri's family or her favorite foods.

Video model 3: Gesture-enhanced conversation. Teri's use of unique and unscripted words continued to increase in this phase, with an average of 36.50 total unique words and an average of 21.83 unique unscripted and 14.67 scripted. Most of the new unique unscripted words in this phase came not from new topics of conversation, but were elicited by the identification of and further discussion of pictures found in the magazines. In the last four sessions of this phase in particular, a strong increasing trend for total unique words and unscripted words is very clear for Teri.

Fading of VMs. The two fading sessions included the highest average for total unique words (52.00) and unique unscripted words (33.50), and the second highest average for unique scripted words (18.50). In the final fading session which took place on the last day of school, Teri used the most unique total words and unique unscripted words than any other intervention

session in the study, elicited mainly by a discussion of packing for a vacation trip the following week.

Ten-week follow up. Teri's use of unique and unscripted words declined in the ten-week maintenance probe with a total average of 26 unique words, an average of 16 unscripted and 10 scripted. While these averages are still well above baseline level, they are lower than every other phase.

Initiations and Responses

Another supplementary source of data in this study was an examination of the number of social initiations and responses in the conversations. The number of initiations versus responses allow a proximate analysis of assertiveness or control in the conversations as initiations reflect a choice to extend interactions. Table 9 displays the mean number of initiations and responses for Teri in each phase of the study and Figure 4 illustrates the data for both Teri and Sonia in a graph. A narrative description follows.

Baseline. In baseline, we have already seen that the number and variety of words used by Teri was limited. By examining initiations and responses, however, we can also see that the average number of initiations (8.40) was roughly equivalent to the number of responses (9.60), which Sonia almost always had far more initiations than responses in this and future phases. Teri's averages are low in terms of their number compared to peer Sonia, who averaged 32 initiations and 12 responses in baseline.

Video model 1: Activity-specific conversation. In this phase there was an increase in Teri's use of initiations to an average of 19.60, doubling her average baseline level. In addition, this was the only phase in which Teri's mean number of initiations was higher than her mean number of responses (13.60). Teri began initiating more activity-specific conversations by

showing pictures to Sonia ("See?" "Ta-da!"), commenting on items she found ("Red one"), or on the materials ("Sticky" glue or "Uh-oh" when she dropped the scissors), taking a more active role in continuing conversation. Sonia's initiations were only slightly above her baseline, so there was space and ample opportunity in the conversation for Teri to initiate. However, while Teri demonstrated an increasing trend of initiations, the level of initiations and responses for both Teri and Sonia remained similar to baseline.

Video model 2: Activity-specific and general conversation. Initiations and responses for both Teri and Sonia in the general conversation intervention phase demonstrated a clear pattern of conversation with Sonia leading the way. As Figure 4 shows, this phase was a turning point for Sonia in terms of her significant increased use of initiations, which correlated to an increase in Teri's use of responses. Most often, that translated into Sonia asking more questions and Teri answering more of them. In Table 9, we see that Teri's average number of initiations fell to 11.67, but this was still above her baseline level. Teri's average number of responses, however, nearly doubled in this phase up to 25.44.

Video model 3: Gesture-enhanced conversation. This phase demonstrated a continuation of the conversation pattern with a high number of initiations from Sonia and a high number of responses from Teri. As seen in Table 9, Teri's average number of initiations declined to 10.50 while her average number of responses continued to increase to 28.17. Meanwhile, Sonia's average number of initiations in this phase was 66.17 and responses averaged 20. Figure 4 shows a widening gap for each conversant between initiations and responses, in inverse directions, with Sonia dominating initiations and Teri primarily giving responses.

Fading of VMs. Although the two fading sessions show a similar pattern as the previous two phases in terms an overall imbalance between Sonia and Teri in their use of initiations and

responses, Teri's average number of both initiations and responses for this phase were above or near their highest level, with an average of 19.50 initiations and 39.50 responses. Further, in the final session, in which Teri's conversation as measured by total words, total unique words, and unscripted words was at its highest, also saw a decline in the number of Sonia's initiations and responses, indicating somewhat less influence and control over the conversation.

Ten-week follow up. In the maintenance probe, the initiation and response data indicate another change in the general pattern of communication between the two. Teri's number of initiations decreased significantly to 10, just above her baseline, while her number of responses declined to 30, which was still in range of the last intervention phase. Sonia's number of initiations returned to her highest level of 79 while her responses decreased to 16, just above her baseline.

Transcript Analysis

A limited analysis of the transcripts of the activity conversations reveals additional data not originally targeted in the research questions, but provides contextual information for further interpretation of the findings in the next chapter.

Conversation turns. The number of conversation turns taken by Teri in the activity sessions is another maker of conversation quality and reciprocity. The average number of words per turn informs the understanding of the general pace and complexity of conversation turns. In the baseline phase for Teri, she took an average of 15.8 conversation turns during the eight minute sessions. Her conversation turns were short, with a mean of 1.29 words, followed by long periods of silent work on the collage. Sonia's average conversation turns at baseline were 16.8 but her average number of words per turn was much higher than Teri's at 12.56. During the VM1: Activity-specific conversation phase however, both Teri and Sonia increased their total

number of conversation turns significantly to 25.4 and 26.4, respectively. Teri increased her average number of words per turn to 2.02 while Sonia decreased her average number of words per turn to 9.78. In the VM2: General conversation phase, Teri continued to increase her average number of turns to 36, but decreased her average number of words to 1.44. In the VM3: Gesture-enhanced conversation phase, Teri's increased her average number of turns to 39.5 while her average number of words remained steady at 1.45. In the fading phase, the number of conversation turns for both Teri and Sonia was at its highest, with an average of 50.5 for Teri and 50 for Sonia. Teri's average number of words per turn increased slightly to 1.56 while Sonia's dropped to a study low of 7.83. In the ten-week follow up phase, the number of conversation turns for both Teri and Sonia decreased to a level near the VM3 phase with Teri at 39 and Sonia at 40 and the average words per turn returned to near baseline levels for both with 1.38 for Teri and 11.13 for Sonia.

Conversation topics and moves. An analysis of specific conversation topics and moves provides some additional insight regarding the potential impact of introduction of the video models. In the baseline condition, there were ten topics related to the activity of making a collage that elicited multiple turns of conversation. Examples of topics include determining the primary color(s) for the collage, discussing whether to use a picture and where it should be placed, and preparing to clean up. Topics that functioned as more of a conversation strategy or talk move related to the activity included asking a question about a picture ("What did you find there?") or saying something to show off one's work to invite a response ("Ta-da"). In baseline there were eight general topics of conversation including using manners (e.g., "thank you/you're welcome" or "sorry/that's OK"), family, Special Olympics, going outside, planned activities, past activities, favorite games, and expressing discomfort.

In the VM1: Activity-specific conversation phase, the VM demonstrated new activity-related conversation topics and talk moves and the number of activity related topics in the sessions increased. The eight topics addressed in baseline continued to be part of the conversation including new variations (e.g., saying "See?" or "Look what I found" instead of "Ta-Da"), and an additional nine topics were added including starting a new collage, proposing a different color to add to the collage, expressing the need to fill in white space, asking questions not just about what a picture is, but what is happening in the picture ("What is he holding there?"), reading something aloud from words cut out of the magazine, or asking which color or previous collage is a favorite. Meanwhile, the number of general conversation topics remained fairly limited, with three of the baseline topics continuing with the addition a new topic about foods eaten for breakfast, lunch, or dinner. In addition, Sonia began using two new talk moves to generate general conversation based on the magazine pictures. She began asking "do you have a [item in photo] like that?" or "do you like to [do the activity shown in the picture]." Thus, conversation topics related to the activity expanded when the VMs of activity-specific conversations were introduced, and the limited number of general conversation topics were derived from the context of the activity and the magazine pictures.

In contrast, in the VM2: General conversation phase, when new models of general conversation were viewed prior to the activity session, the number of activity-specific topics remained steady while the number of general topics more than doubled. While activity-related topics remained the same, Sonia did develop a new talk move she used when discussing where pictures should go. Instead of asking yes/no questions, she began asking forced choice questions: (e.g., "Should it go on the top or the bottom" or "Does it look best in the middle or in the corner?"), a move that was modeled in the activity-specific VMs. Meanwhile, the number of

general topics of conversation exploded following the introduction of the VMs of general conversation with twelve previous topics maintained but adding more than fifteen new ones including Prom, Teri's pet dog, many variations of favorite things, musical genres and instruments, and computer activities. Sonia used force choice questions in general conversation as well (e.g., "Do you like Snickers or Skittles better?"). In this phase, the pair discovered that Teri's taste in music ran more to oldies groups that Sonia had never heard of, like the Doobie Brothers and the Beach Boys, and they found that they shared a love of Chinese food.

In the VM3: Gesture-enhanced conversation phase, when the VM scripts changed little except for the addition of gestures, there were few, if any new topics, only new variations on previous themes. The most notable changes in the sessions were the increased use of gestures and the only instances of Teri and Sonia following the VM script verbatim, at least for the first three turns. In the gesture-enhanced VMs, each script begins with Teri greeting Sonia and waving, Sonia greeting Teri and waving, and Teri asking Sonia, "How are you?" This was exactly how Sessions 91, 93, and 95 began. This was also the only phase in which Teri used the words "awesome" and "cool" more than once, important because these were two of the most common words used by the peers in conversation and also ones they had developed a special gesture for in the VMs.

Asking and responding to questions. Another clear pattern in the conversations across the phases of the study was a steady increase in the average number of questions Sonia asked per session paired with a steady increase in the percent of those questions that Teri answered. In the first five baseline phases, Sonia asked a total of 107 questions or an average of 21.4 questions per session. Teri gave a response to only 40.19% of these questions, another indication of the awkwardness of these initial conversations. In the VM1: Activity-specific conversation phase,

although Sonia asked slightly fewer questions per session (18.83) Teri answered 62.83% of them. In the VM2: General conversation phase of the study, Sonia increased her average number of questions per session to 33.44 and Teri increased her average responding percentage to 71.10%. In the VM3: Gesture-enhanced conversation phase, Sonia increased her average number of questions per session to 34 and Teri increased her average response rate to 74.02%. In the two fading sessions, the performance of both were at their peak with Sonia asking an average of 40.5 questions per session and Teri answering 85.19% of them. In the ten-week maintenance probe, Sonia continued to demonstrate a high rate of questions at 39 for the session, but Teri responded to only 69.20% of them.

Social Validity

Ratings by educators. Eight special education teachers and paraeducators from Teri's school viewed two short clips of conversation, one from the first day of baseline and the second from the last day of intervention. The educators were asked to rate each clip in seven areas with a five-point Likert scale (1=strongly disagree, 2=somewhat disagree, 3=neutral, 4=somewhat agree, and 5=strongly agree). Six of the educators wrote comments on the form, with three of them specifically noting improvements for both the peer and the student with ASD (e.g., "Both students were much more engaged. Peer did better drawing out conversations. Teri had many more words and engagement!" and "Both of the students got better with their social skills and got to know each other better"). See Table 7 for means and standard deviations of responses to each question.

Focus group comments from peers. Near the end of the study, three of the peers (Sonia, Susannah, and Melina) participated in a focus group interview and were asked the following questions: (a) What did you think about the process of creating the video models? (b) What did

you think about watching the video models? (c) Did you think the video models helped Teri's conversation skills? and (d) Did creating or viewing the video models have any impact on your own conversation skills?

In general, all of the peers reported that the process of creating the video models was positive and relatively easy. Melina explained that creating the scripts "wasn't hard, it was just typing up what your conversation would be like with any person…normal things like Prom or spring break or what kind of collage to make." However, she was also aware that "I use different language with Teri or like form sentences differently and I wanted her to learn conversations that like I'd have with someone without a disability, you know? So, I'd picture it like I was talking with Sonia." Susannah agreed, "I'd make it like I was talking to Melina or Sonja and like also being realistic about what Teri does like and can say and kind of like mixing that in." Susannah noted that while the resulting VMs were "kind of corny" and the scripts were "not completely natural," she enjoyed seeing how excited Teri got watching the VMs and the progress she made: "It was like, 'oh my gosh, we helped do this.'" Overall, she felt that the VM "is really empowering" for Teri.

Megan, who was only involved in the video production sessions, described some anecdotal improvements outside of the study. "With me, it seems like watching her talk with me in the videos has made her talk to me more in real life…. I'm in class with her for reading…. [but] I hadn't really talked to her much before the videos. It was the videos like we got to know each other and now like she will even say stuff to me in the hallway, like go out of her way to say hi…. I mean, yesterday she said to me, 'I'm feeling tired.' I mean, she never would have said that full sentence before…. She also gave me a thumbs up." Sonia agreed: "Yeah, well I sat with her every day in math, but she never talked to me. But then we started this and now she talks to

me all the time…. like in choir now we will talk, but not always like full conversations, but I know what she is talking about because I pick up on what she means, and people kind of stare at us and say 'how do you know what she's saying?' It's cool because we are having our own little kind of secret conversations over here…. It's like there is a special bond now." Melina noted that another key to the increase in communication is "we just know more about her" so there was more to talk about. Sonia added that it was also important to know more about "what she is capable of saying and expressing and knowing what to say to get the answer out."

I asked Sonia directly how much she felt that she was the driver of the conversations and what role that might have played in any improvements in Teri's communication. She responded, "Well, I felt like a lot of it, I kind of was [the driver of conversation]…. sometimes I kind of had to force it out of her. Wait, that sounds bad, but I mean just knowing to ask follow up questions like 'what else did you do' or 'did you do this?' Sometimes when I knew what the answer is, I just want to get her to say it herself…. I was trying to get her to talk more, but it was like I was just feeling more comfortable talking and that made her more comfortable talking. I mean at first it was a little awkward, like I didn't know what to say, but I don't know, then it changed…. when she would say something like I would repeat what she said and then ask a follow up question. And I've noticed myself doing that in real life."

Sonia was not the only one with examples of how the study had impacted their own communication skills. Susannah shared "I notice myself picking up more on gestures. I was with my grandma and she was telling me a story in the car, and I was like 'Grandma, that's awesome' and I did a fist pump, and then I was with some little girls at dance class and we were doing snacks and I was like 'aren't these really tasty, you guys?' and I rubbed my hands together. It's funny."

In different ways, each of the peers commented on adaptations they had made in their approach to conversations and to Teri. Megan shared "I learned that you can have a conversation with like anyone. Like even if they don't give you the response you want, you can still try to talk. Like if I hadn't done this study, I don't think I would have known the right way to ask questions and then I probably wouldn't talk to her as much as I do. So, I guess I learned how to make things easy for her to understand and how to respond."

Chapter 5: Discussion

Preview

In this section, I review the problem of social skills for adolescents with ASD and how the problem is situated within the theoretical frameworks of social skills, social competence, and social learning. Next, I examine the findings and how they can be interpreted within these frameworks and previous studies and critically review the limitations of the study. Finally, I explore practical implications of the findings and recommendations for future research.

Review of the Problem

Previous chapters have described the problem in broader, theoretical, and societal terms, but this study confronted the problem as experienced by a particular individual and her social context. Teri is a young adult with ASD and social skills are difficult for her. Teri's mom, teacher, and peers reported that she rarely initiated conversations and that her verbalizations were limited to one or two-word phrases. While Teri participated in organized social activities with others her age with disabilities, her primary social interaction partners were her mother and her older sister, not same-age peers. Although Teri was included in Choir class with the study peers and the peers had completed a cadet teaching experience in Teri's special education classroom, peers reported that they had not previously had conversations with her during that shared time. The social skills Teri used most fluently before the study included greetings, using manners, smiling, and eye contact, but these were not sufficient to result in extended interactions or conversations.

Social skills are understood to include simple skills such as greeting or answering a question that must be combined in meaningful and contextually-appropriate ways to result in more complex social skills such as conversation. Gresham's (1998) model of social competence

(see Figure 1) illustrates how social skills, adaptive behaviors, and peer acceptance contribute to overall social competence. According to social learning theory (Bandura, 1987) all of these behaviors and skills are learned through the modeling that occurs in daily life interactions, but for those with ASD this process is impaired by difficulty focusing on the most socially salient cues (Klin, Jones, Schultz, Volkmar, & Cohen, 2002; Bushwick, 2001). Video modeling has shown some success in solving that problem by using visual processing strengths of those with ASD and the ability to select and repeatedly view with predictability the most salient models.

This study applied VM to improve complex conversations mediated by authentic practice with peers in school and community settings. The aim was to increase the number of scripted and unscripted words, initiations and responses, and gestures used by the participant with ASD, and to analyze the same for her peers to better understand the role that peers played in mediating the VM intervention. I turn now to exploring the evidence of the impact of VM and other variables and interpreting the results discussed in Chapter 4.

Summary of Findings

The results suggest that the intervention, a combination of VM and minimal peer mediation, supported improvements in multiple measures of complex social skills for an adolescent with ASD, with generalization across settings, peers, and to unscripted words. However, as discussed below, the direct role of VM in these improvements is compromised by multiple limitations. Improvements may also be due to the effects of practice, learning more about each other rather than learning new skills per se, and a response to new conversation behaviors employed by the peer.

Research question 1: Will VM result in an increase in the number of words and gestures used in conversation by the student with ASD and her peer? The experimental

design allows the clearest potential demonstration of VM control over the variables of the number of words in activity-specific conversation and general conversation and the number of gestures, as these were the three behaviors in the multiple baseline design (See Figure 2). Four previous VM studies found that VM increased the number of words/verbalizations (Kim, 2015; MacDonald, et al., 2009; Maione & Mirenda, 2006; and Taylor et al., 1999) but all of these were with young children, not adolescents, and the increases were limited to about three verbalizations per minute.

In the current study, although the number of words and gestures used clearly increased, the evidence of VM control is compromised and secondary data sources show uneven evidence of VM impact. VM may have played some general role in prompting peer Sonia to engage in specific types of conversation more effectively with Teri, but perhaps the regular, enacted practice alone accounts for much of the improvement as the two young women co-constructed topics of shared knowledge and interest during the activity sessions.

Number of words and gestures by Teri. In this study, two of the baselines (i.e., activity-specific conversation words and general conversation words) were compromised, limiting the evidence of experimental control. As reported in Chapter 4, in the activity-specific baseline there was a slight trend of increasing words in the first four data points that was magnified by a large increase in the post-video production probe taken a full four weeks later. The long delay was caused by scheduling conflicts with weather cancellations, state competitions, spring break, and timing issues with script completion and recording of the VMs. In addition, producing this first video model took more time and rehearsal than subsequent ones did (five full days of rehearsing and experimenting with different script forms for the first VM compared to one day of recording for the final VM). The post-production probe therefore represents not only the impact of VM

production but also the impact of time, learning, and practice providing evidence that these variables also supported overall improvement.

The general conversation behavior baseline was also compromised by a trend of improvement, with four of the nine data points showing an increase. In addition, one outlier data point in baseline overlaps with many of the intervention phase data. That outlier was caused by Teri reading the written lunch menu aloud, Teri's longest conversation turn of the study, totaling 26 words and accounting for more than 80% of her general conversation words in that session. However, reading the lunch menu verbatim is quite different from improvising general conversation, which I argue minimizes the compromise of the overlap.

As Figure 2 shows, following the introduction of Video Model 1: Activity-Specific Conversation (VM1), there was an immediate increase in the number of activity-specific words, but this increase is tempered by the increasing trend in baseline. Prior to the introduction of Video Model 2: Activity-Specific and General Conversation (VM2), a post-video production probe was collected under baseline conditions (i.e., no viewing of VM prior to activity). That probe on day 57 showed a decrease in activity-specific words and continued low levels of general conversation words and gestures, which offers some evidence that the improvements during the VM1 phase relied to some extent on viewing the VMs. In addition, transcripts show that Teri answered more questions, increased the number of conversation turns and words per turn, and that conversation topics increased, all as modeled in VM1.

The introduction of Video Model 2: Activity-Specific and General Conversation (VM2) resulted in a gradual increase in general conversation words while the number of activity-specific words remained above baseline levels and the number of gestures remained low, which may demonstrate some control of VM, but the increasing trend in baseline confounds that evidence.

The means for each behavior in Table 7 provides additional evidence of changes in overall levels and trends. Finally, the post-video-production probe on day 79, collected under baseline conditions without VM viewing, show a significant decrease in general conversation words, providing some evidence for the control of viewing VM2 on general conversation. Transcripts of this phase show that Sonia's rate of questions increased as did Teri's rate of responding and her number of conversation topics, turns, and words per turn, much of which was modeled in VM2.

The introduction of Video Model 3: Gesture-Enhanced Conversation (VM3) showed an immediate increase in the number of gestures across video models. While single-subject designs require a standardized scale for each baseline, it is important to note that in normal conversation gestures are not typically used for every word spoken, so the appropriate number of gestures to expect in a conversation should be much lower than the number of words. Figure 4 displays the gesture data for both Teri and Sonia with an adjusted y-axis scale to show a more detailed look at improvement. While Teri's increase in gestures were smaller in number compared to her increased number of words, the peer comparison data is an important normative marker in terms of the social validity of Teri's increase. The increase in the number of gestures, is an important contribution to the literature as few studies VM and social skills included gestures at all and those that did reported very limited results (Gena et al., 2005, Macpherson et al., 2015). Transcripts show that the gestures Teri used in this phase were not used in other phases and were directly modeled in VM3 and that Teri for the first time repeated lines of the VM3 script verbatim, offering some evidence of the impact of VM3 on gestures and conversation.

The two fading sessions on day 97 and 98 show different patterns among the behaviors. Activity-specific conversation, the behavior that had the longest VM intervention was least impacted by fading back the VMs, instead continuing an increase to the highest level in the

study. Fading resulted in a small decline in general conversation words but still well above baseline levels. For gestures, the behavior that appeared most responsive to VM3 intervention but also the fewest repetitions of viewing the VM and fewest practice sessions, fading resulted in significant declines with a mean at or below some of the baseline phases, indicating that VM's impact was short-lived.

The generalization probes, conducted in different settings and different peers, and conducted without first viewing video models provide evidence of generalization effects, as well as additional evidence on the importance of peer mediation. Melina, Marlo, and Susannah served as the lunch conversation partners. They also scripted and performed in the VMs, but never viewed the edited, finished products like Sonia and Teri repeatedly did. The three were generally more talkative and gestural than Sonia and more likely to focus on general conversation topics than lunch or the collage activity. In the baseline generalization probe, although Melina used more than double the number of general conversation words and gestures than Sonia did and about a quarter more activity-specific words, Teri's use of these three behaviors remained low, perhaps underscoring the general awkwardness of the initial baseline sessions. In all other generalization probes however, the other peers used far more words and gestures than Sonia used, and Teri responded in kind, with much higher average number of words and gestures. Therefore, the generalization data suggest that improvements in Teri's conversation skills may simply depend on the mediation by and behavior of the peer conversant than on the VM intervention itself.

The ten-week follow-up probe demonstrated continued high levels of general conversation but a steep decline in activity-specific conversation and gestures. Teri's mother reported that Teri did not continue to make collages on her own at home, so that type of

conversation was not practiced or reinforced in the weeks following the study. The maintenance of general conversation words may be related more to the repertoire of topics, talk moves, and shared knowledge the two had developed in practice rather than the direct impact of VM as Sonia took the conversation initiative and introduced new topics based on the summer context as well as returning to favorite topics from previous conversations.

Number of words and gestures by peer Sonia. Based on insights from previous VM studies (MacDonald et al., 2009; Thiemann & Goldstein, 2001), peer data were collected to allow for a more nuanced interpretation of changes in Teri's behavior. As Figure 3 shows, Sonia's number of activity-specific and general conversation words and gestures increased following the introduction of VM, but the increases were gradual, not immediate. Sonia was not involved in the scripting and production of the VMs and was given no training or coaching other than viewing the VMs with Teri before each activity session. Like Teri's baseline data, Sonia's data are also compromised by the large increase in activity-specific words in the post-video production probe on day 36, which demonstrates that time, outside learning, and other variables also had an impact on her behavior. Transcript analysis suggest that VM may have played some general role in prompting and directing Sonia about how to engage more effectively with Teri with each of the target behaviors (e.g., talking more about the activity, increasing general conversation topics, increasing the number of conversation turns, shortening the average number of words per turn, and asking more questions as modeled in the VMs). However, Sonia also developed other talk moves never modeled in the VMs, such as repeating what Teri with a rising intonation as if asking a question and making a follow up comment. Unlike Teri, Sonia maintained a high level of activity-specific and general words and gestures in the 10-week follow up probe as well as a high number of questions she asked.

Many previous VM studies in the literature have used peers as interaction partners but few have collected data on the behavior of the peers. Previous studies that have included peer data show that the social behavior of peers also improves with VM (Cardon & Wilcox, 2011; MacDonald, et al., 2009) or after prompting or coaching of the peers (Sansosti & Powell-Smith, 2008; Thiemann & Goldstein). In the current study, the collection and analysis of peer data offer some evidence that the VM may have had some impact on the peer, who in turn mediated the VM effect to the student with ASD. That finding raises questions about the mediating role peers may have played in previous VM studies involving peers and underscores the importance of collecting peer data in any study of social skills that involves peers. As the social enactment literature emphasizes, social interactions are co-constructed and the role peers play should be measured in order to fully understand intervention components.

Research question 2: Will VM result in increased use of unscripted words as well as those scripted in the models? The data do not allow this question to be answered empirically. Instead, scripted and unscripted words provide supplementary data about generalization and overall conversation quality. In most of the VM studies that targeted conversations, (Charlop & Milstein, 1989; Plavnick et al., 2013; MacDonald et al., 2009; Sherer et al., 2001; Tetrault & Lerman, 2010; Thiemann & Goldstein) participants rehearsed and learned to recite the script verbatim through training trials and were then probed for maintenance of the script use. Findings of robust generalization to unscripted conversations are rare in the VM literature (MacPhearson et al., 2015 and Maione & Mirenda, 2006). In this study, I structured the procedures to include multiple exemplars, to use common stimuli and natural reinforcers and loose procedures to program for generalization to unscripted words and conversations. Even so, I had originally hypothesized that Teri would learn to repeat scripted phrases and interactions first and unscripted

topics and phrases would come later, if at all. Instead, as seen displayed Figure 5 and with means by phase in Table 8, the number of unique unscripted words were consistently greater than the unique scripted words in all phases of the study. While previous VM studies that focused specifically on correct responding to a scripted set of the questions repeated every session (e.g., Sherer et al., 2001), Sonia's questions varied in each session. Therefore, Teri's high response rate in fading to a diverse array of questions, many of which she had not been asked before, is impressive.

The robust unscripted verbalizations in the current study are important because authentic social conversations are not scripted. This finding is also notable because few other VM studies have targeted them in the first place (Kim, 2016; MacDonald et al., 2009; Taylor et al., 1999) and even fewer have found good results (Maione & Mirenda, 2006; MacPherson et al., 2016). Interestingly, as described in Chapter 3, the two VM studies and complex social skills with the most significant unscripted results were those that used loose training procedures and naturalistic and unstructured settings for social interaction, an approach also used in the current study. Further research using a more direct comparison of VM and highly structured procedures and contexts (e.g., Plavnick et al., 2013) and loose procedures and natural contexts (e.g., Macpherson et al., 2015) could illustrate variations of VM for different purposes and outcomes.

Research question 3: Will VM result in any changes in the number of verbal initiations or responses used in conversation? Again, the data do not allow this question to be answered empirically. Instead, these supplementary data help contextualize changes in conversation. Initiations indicate driving a conversation forward in an intentional way while responses are more passive (Muller & Soto, 2002). The VMs were constructed to demonstrate an equal number of initiations and responses by both Teri and the peer. Maione and Mirenda (2006)

found robust improvements in initiations that far exceeded that modeled in the VM, and I was hoping I might find the same, or at least something closer to what was modeled. Instead, as seen in Figure 6 and in the means reported by phase in Table 9, and as partially explored in the section on questions asked and responded to in Chapter 4, the overall pattern across most of the phases was of Sonia increasing her number of initiations and Teri increasing her number of responses.

This secondary data suggests that the more direct influence of VM may have been to prompt Sonia to extend conversation and develop new topics, talk moves, and strategies in step with the specific behaviors modeled in VM1, VM2, and VM3 and to help Teri learn to respond to Sonia's direction. Unlike previous studies that attempted to use VM only to teach a particular script to peers and children with ASD, VMs also model general examples of other aspects of complex skill like conversation such as suggesting topics, pacing, turn-taking, gestures, and talk moves that can lead to improvisation rather than memorization of a script. Although such improvisation is challenging, the current study demonstrates that a peer can learn to skillfully initiate, scaffold, and extend communication and a student with ASD and developmental disabilities can learn to consistently respond to those overtures without any coaching other than that provided in the VM itself.

Research question 4: How will the peers and educators at the school rate the social validity of the goals, procedures, and outcomes of VM? The social competence model described in Chapters 1 and 2 defines peer acceptance and the social evaluations of other important people like parents and teachers as critical to validate skills that contribute to competence. The social validity data in Table 10 from teachers and paraeducators at Teri's school show that the educators recognized and celebrated improvement in the communication skills of both Teri and Sonia. In fact, the biggest increases in their mean rating was for the

statement “the peer shows good skill in drawing out conversation” and “the peer and the student with autism seem like they know each other well.” Each of those statements supports conclusions discussed above regarding the importance of Sonia’s role as a conversation leader and Teri’s responsiveness to peer direction. While the survey did not inquire about their acceptance or rating of the intervention of VM, their invitation for me to share the findings of this study with them and their stated interest in developing a library of VMs for job coaching or life skills in addition to social skills suggests that they view VM as promising and possible in their classrooms.

There are many limitations to note about the social validity data. First, although the order of the clips was counterbalanced, the educators easily deduced which was from baseline, as indicated from their verbal and written comments, although I did not confirm their assumption. Second, although only one of the educators was involved with the study directly, it was also clear from their comments that they were not blind to the purpose of the study. Third, although the questions asked were parallel to those asked in previous VM studies (e.g., Charlop & Milstein, 1989), the questionnaire is not a reliable or validated instrument. Finally, all of the teachers and most of the paraeducators are people I know on a professional and personal level, predisposing them somewhat to tell me what they think I wanted to hear.

The focus group interview with three of the peers in the study offer additional social validity data in terms of the acceptability of the VM intervention and their reports of improvements in Teri’s conversation with them outside of the study and in their own communication skills. As the social competence model (Figure 1) theorizes, peer recognition of Teri’s improved social skills and the increased frequency of their conversations with Teri in the hallway and in other classes when this did not occur previously, contributes to Teri’s overall

social competence. An important limitation of the focus group data includes the fact that none of the peers were blind to the purpose of the study and were directly involved in the intervention, making them more likely to identify positive outcomes or to tell me what they think I wanted them to say, and there was no pre-study focus group for comparison.

Several previous VM studies have asked educators to view and rate pre- and post-intervention clips of social interactions to demonstrate socially valid improvements (Charlop & Milstein, 1989; Charlop et al., 2010; Day-Watkins et al., 2014; and Reeve et al., 2007), but only one did so in a way in which the peer activity partner's behavior was also rated pre- and post-intervention. Like the current study, Thiemann and Goldstein (2001) found that teachers and others rated the social behavior of both the peers and the students with ASD higher post-intervention, specifically in their ability to draw others into the conversation, to respond to communication attempts, and to initiate questions or comments. This again underscores the important role peers play in social intervention research and how collecting data about peer behavior provides a more complete and complex picture of outcomes. No other VM study reviewed collected direct focus group interviews with peers about the intervention and results, and I contend that for any study of social skills for adolescents, peers are the primary arbiter of social competence and should thus be the source of social validity ratings and feedback.

Limitations

This study has a number of limitations, some already discussed previously, others explored below. First, this study had only one participant with ASD, which limits the applicability of findings for others. However, given the small number of studies of VM with adolescents, even an addition of one to the literature is still a real contribution. Second, the study was quite long, with 98 calendar days from the first baseline probe to fading and 168 calendar

days to the final maintenance probe. In that period Teri and Sonia viewed the short VMs a total 41 times, representing a total of about an hour of VM-viewing intervention followed by 27 activity sessions totaling 3.6 hours. That intervention time is dwarfed by the thousands of hours, other experiences and social interactions, and many other opportunities for learning. The length of the study makes it more likely that variables outside of the study or simply the natural learning that comes with time and practice may account for the improvements. Another limitation is the fact that I was the primary data collector for the study and was present for all sessions. While the high inter-rater agreement is one check on some kinds of bias, my presence and non-recorded interactions with the peers and with Teri could have inadvertently served as prompts or reinforcement for behaviors I was hoping to see or other potential influences. Finally, the three target behaviors were closely related to each other in topography, which may have contributed to interference of impact.

Implications for Practice

One major implication of this study is the high degree to which adolescents can be recruited to manage and direct social skills interventions from the beginning of an intervention, a recommended but rarely-found practice (Carter, et al, 2014). This is especially important at this age, when peers exert the greatest influence on social culture, norms, and values in a given context like a school. In this study, three of the peers created conversation scripts and recorded the video models. Although I took charge of editing the videos into the VMs themselves, all of the peers reported experience and familiarity with video editing. This may be unique to school districts like theirs that provides 1:1 mobile devices, enabling teachers to incorporate new media into their assignments, but the growth of YouTube and video-based social network platforms suggest a high degree of comfort with creating videos among this generation. Although

classroom teachers have reported some reticence and doubt about their ability to create and use video models (Heckman, Cummings, & Bellini, 2014), adolescent peers who are already volunteering or serving as cadet teachers and the peers in this study were doing should be considered for scripting, recording, editing, and viewing video models. In addition, the choice of social activity type and content of the conversation scripts are made more valid when made by peers rather than adults.

Another implication is that a more active mediation role for peers pairs well with video modeling. Ogilvie (2011) described clear steps teachers can take to create video models with peers and create groups to view and practice the skills with students with disabilities. LePage and Courey (2011) have taken a slightly different but similar approach in a reverse inclusion program to develop social skills in adolescents with ASD by forming heterogeneous filmmaking video groups to develop creative VMs or social stories around targeted social skills. In the groups, students with autism and those without disabilities write scripts together, set up scenes and arrange for costumes and props, and practice and record the movie and add music and sound effects post-production. Cardinal et al., (2017) found that paraeducators can also play a direct role in implementing web-based VMs.

Another implication is the opportunity for programming regular social interaction activities with peers into the regular school day. The Power Hour lunch and remediation time at this school is becoming a common part of the schedule as many schools adopt Multi-Tiered Systems of Support, and provides a built-in time for high achieving students in need of enrichment and students with ASD in need of social interaction and skill development to meet. It would be very easy to structure a game day or craft activity day each week during that time that would be beneficial for all involved, with or without the addition of VM. Such interactions help

push through the “brick wall of awkward” in social interactions between peers and those with ASD (Bottema-Beutel et al., 2016) and encourage greater peer acceptance of students with ASD and fewer conflicts and difficulties (Humphrey & Lewis, 2008). Peer buddy programs daily social interaction with students with severe disabilities have resulted in benefits for both the peers and the students with disabilities (Hughes, et al, 2001).

Recommendations for Future Research

One single-subject study on the use of VM with an adolescent with ASD to improve complex social skills is far from sufficient to close the gaps in the literature identified in Chapter 2. Far more research is needed on the use of VM with adolescents and young adults and to improve complex social skills. Given the mixed results in this study and the finding that few previous studies used VM alone to improve complex social skills, further research should examine the limitations of the power of VM alone by comparing it to conversation practice alone or by systematically adding other treatment components.

The current study programmed for generalization using multiple exemplars, common stimuli, natural reinforcers, and perhaps most importantly loose training procedures and these were followed by strong unscripted and generalized outcomes. Research that directly compares unscripted and generalized outcomes using loose training procedures with VM and tighter trained-to-criterion procedures on simpler, discrete aspects of conversation (e.g., greetings, giving compliments, answering questions, asking questions, making observations) as well as additional research that explicitly targets generalized and unscripted outcomes would make important contributions to the literature.

In the current study, data collected from peers involved in the study provided important evidence of how the peers may have mediated the impact of VM. Although several previous VM

studies have so in the past with similar results, collecting peer comparison data is far from standard practice. Future research with VM that involve peer interaction partners and peer models should include peer data to both monitor the potential impact of the peers and as a normative comparison.

There have been a number of recent qualitative studies of conversation skills and adolescents with autism (Bottema-Beutel & White, 2016; Bottema-Beutel, Louick, & White, 2015; Bottema-Beutel & Smith, 2013; Bottema-Beutel, 2011) that can inform the development of both VM of conversation and peer orientation practices. Mixed-methods studies that pair single-subject empirical designs with qualitative methods like discourse analysis may also hold great promise to illuminate and more fully understand complex intervention on complex skills. Another approach for VM research and complex social skills would be to follow the lead of Taylor et al. (1999) and to employ VM first with simple or limited social skills and then systematically combine them or use forward-chaining procedures to progress towards more complex skills.

My review of the VM literature in Chapter 2 and the findings of the small number of studies using VM as the sole intervention, the narrow fairly narrow range of successful outcomes, and limited generalization and maintenance effects make me question VM as an evidence-based practice for adolescents with ASD and complex social skills. While the current study finds some limited evidence of the impact of VM in such contexts, it is clear that far more research is needed to reach an EBP conclusion in this specific area. It is possible that the paucity of published studies of VM with adolescents with ASD is not the result of few studies conducted in this area but rather few studies with positive results and a positive publishing bias. In particular, a focus on improving social initiations, unscripted and other generalized conversation

should be a priority. The current study focused on only one form of nonverbal communication, gestures with positive results, but other nonverbal forms such as facial expression, intonation, stance/orientation, and eye contact/gaze also play a role in social skills and competence. More research is needed not only on the coordination of gestures with verbal communication but also coordination of other forms of non-verbal communication.

Conclusion

The current study makes several unique contributions to the literature of VM and interventions to teach complex social skills. First, VM can effectively model complex social skills for adolescents with ASD and can support unscripted and generalized verbal responses and gestures. Second, the impact of VM can be boosted and mediated by the influence and direction of the peer activity partners. For adolescents in particular, the mediation and directive influence of peers is key to social skill intervention success and the current study offers evidence that peers stand ready, willing, and prepared to assist and that trends in secondary school contexts have created ready-made opportunities for these interactions to occur. Third, the inclusion of peer data can provide an important aid in the interpretation of results and a socially valid normative comparison. Finally, given the mixed results, the study demonstrates that VM is not always as effective as previous studies have found, at least in terms of complex social communication skills in adolescents with ASD.

Table 1: VM and Extended Verbal Interactions

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Charlop & Milstein, 1989	6-7 years old	•conversation turn that included a response and appropriate follow up question •three conversation turns in each VM •ancillary behaviors included response variation and asking questions in after school program	generalization probes with sibling or peer	+multiple exemplars: five scripted conversations +toys as stimuli +access to toys as natural contingencies -/+structured trials using contrived opportunities until child met criterion, then probes of unstructured interaction	•generalization across settings, persons, and conversations, but scripted and unscripted reported as single total •response variation increased, reported separately •question asking increased
Kim, 2016	6, 7, 9 years old	•sequences of multiple play verbalizations and actions while interacting with toys and mother	None	-one video clip per child +toys as stimuli +access to toys as natural contingency +train loosely: only structure for interaction was presence of toys	•rapid increase in number of scripted verbalizations and actions, little to no increase for unscripted •generalization to novel toy

Table 1, cont.

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
MacDonald et al., 2009	5 - 7 years old	•reciprocal verbal interaction chains •scripted and unscripted verbalizations and play actions •cooperative play	•peers as interaction partners •peers coached to follow script •peer comparison data reported	+multiple exemplars: three scripts of verbalizations and play actions +toys as stimuli +access to toys and peers as natural contingencies -/+video viewing and practice until child reached criterion with scripts, loose free play structure followed	•increase in scripted verbalization and actions •some increase in unscripted verbalizations reported in one child •increase in cooperative play •increase in reciprocal verbal interaction chains
Maione & Mirenda, 2006	5 years old	•scripted and unscripted verbalizations •initiations and responses •10-12 turns of play conversation in each VM	•peers as activity partners	+multiple exemplars: three VMs for each of three playsets +toys in home as stimuli +access to toys as natural contingencies +train loosely: no training to criterion, free play sessions with given toys	•high response generalization, larger increase in unscripted words than scripted •anecdotal report of setting generalization •higher increase in initiations than responses
Mason et al., 2012	College students, aged 19 and 26 years old	•ratings of conversation turn taking, eye contact, facial expression, and sharing emotions	•peers as models in VM •peers as conversation partners	+train loosely: unscripted VMs of spontaneous conversation followed by unstructured 5-minute conversation sessions	•statistically significant increases in ratings of all four behaviors •no generalization or unscripted data given

Table 1, cont.

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Plavnick et al., 2013	13-16 years old	•reciprocal social interaction: makes verbal response and follow up initiation •social initiations: moving in proximity to peer, using name and an invitation to an activity, then engaging in activity •social awareness: asking about interests and offering assistance	•peers as interaction partners •peers as models in VM and in-vivo as part of group	+multiple exemplars: three VM for each social behavior +preferred activities as stimuli +access to preferred activity as natural contingencies -highly structured trials with five to seven contrived practice opportunities	•increase in percentage of trials with correct response to 100% for all four participants •generalization results not reported •unscripted responses not reported, but were counted as 'correct' if appropriate
Sansosti & Powell-Smith, 2008	6-10 years old	•maintaining conversation for one student •joining in: verbal and nonverbal, for two students	•peers as models in VM •peers present as possible activity partners •peers coached to respond •peer comparison data reported	-one Social Story VM per student +playground equipment as natural stimuli +access to preferred activity as natural and recruited contingency +no training to criterion, unstructured playground time	•increase in percentage of intervals with target behaviors equivalent to peers •generalization with one student to another setting

Table 1, cont.

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Sherer et al., 2001	4-11 years old	•answering eight questions and making appropriate follow up response to each	•peers as models in VM	+multiple examplars: two VMs per child, one with self-model, one with peer model +common questions identified by parents as natural stimuli -contrived opportunities to practice with researcher in home	•three of five increase percentage correct to 100% criterion •improvement for other two, but do not reach criterion •lack of overall difference in type of model in VM no generalization to non-scripted questions
Taylor et al., 1999	6 and 9 years old	•scripted and unscripted play comments	•sibling as model in VM •sibling as activity partner	+multiple exemplars: three VMs for each child included average of six play comments with forward-chaining for one child to increase the number of comments viewed +preferred toys as stimuli +access to preferred toys as natural contingency -/+structured script reading in one, loose forward chaining in second	•increase in correct scripted statements to 100% for one child with no unscripted comments •increase in number of scripted and unscripted play comments for second child

Table 1, cont.

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Tetrault & Lerman, 2010	4, 5, and 8 years old	•scripted verbalizations that include five conversation exchanges, actions, and eye contact	•peer as model in VM	+multiple exemplars: three scripted sequences of social interactions +toys as stimuli +access to toys as natural contingency -structured opportunities to re-enact scripts. least-to-most prompts	•one of three students increased both scripted responses and eye contact across three conversation types and some generalization with different toys
Thiemann & Goldstein, 2001	6, 7, 8, 11, and 12 years old	•collateral data on topic maintenance and sequential verbal utterances per conversation •initiation comments, contingent responses, securing attention, making requests	•peer as model in VM (video feedback) •peer as interaction partner •peers as mediators (feedback) •peers trained to interact	+multiple exemplars: novel video models for feedback each session +self-monitoring as functional mediator +/- interaction time structured with adult prompts if target skill not emitted once per minute, visual cue speech balloons from Social Story present	•increase in the number of target behaviors •increase in the average number of utterances per conversation •limited generalization reported

Note. +=strategies known to increase generalization, - = strategies that may limit generalization (Stokes & Osney, 1989)

Table 2: VM and Complex Coordination of Verbal and Nonverbal Communication

Study	Ages of Participants	Complex Social Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Charlop et al., 2010	7, 8, and 11 years old	•three responses that include a verbalization, intonation, gesture, and facial expression (e.g., After making a basket: "I got it!, exclamation, thumbs up, with smile)	•peers as activity partners in generalization probes	+multiple exemplars: three VMs for each of three response types +preferred toys as stimuli +access to preferred toys as natural contingency -structured trials using contrived opportunities until criterion reached	•increase in percentage of opportunities correct to 100% for verbalization, intonations, gestures, and facial expressions •generalization to peers and other settings and materials •anecdotal reports of response variation
Day-Watkins et al., 2014 (replication of Reeve et al., 2009)	13-18 years old	•discriminating the need for help, offering a verbal offer to help and nonverbal action	•peers observed to identify helping interactions	+multiple exemplar: five examples for each of five categories of helping +common stimuli, toys, pens, desk -structured trials using contrived situations	•increased percentage correct response to 100% •generalization across responses, settings, people, but not as strong as Reeve et al. (2009)

Table 2, cont.

Study	Ages of Participants	Complex Social Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Gena et al., 2005	3, 4, and 5 years old	•three responses that included a verbalization, eye contact, facial expression, and gestures (e.g., showing appreciation by saying "Thanks, I really like that" while smiling and giving eye contact	•peers as models in VM	+multiple exemplars: 140 scenarios used +toys as stimuli +access to toys as natural contingency -structured trials using contrived opportunities followed by error-correction followed by unstructured probes	•increases in percentage of appropriate responses to 100% •generalization across people and scenarios •no data reported for gestures
Litras, 2010	3 years old	•greeting, inviting to play, and contingent responding, definitions include proximity and nonverbal •concomitant changes in social engagement, verbal communication	•peer voice as model (puppets used in VM)	-one video model per behavior -three contrived opportunities for each behavior, followed by generalization probes during free play +toys as stimuli +access to toys natural contingency	•increase in percentage of behavior for scripted to 100% •setting generalization of inviting and responding to 100%, greetings to 67% with different materials or unscripted responses

Table 2, cont.

Study	Ages of Participants	Complex Social Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Macpherson et al., 2015	9, 10, 11 years old	•verbal compliment paired with a gesture (e.g., "That was a great kick" with a fist pump)	•peer for interaction •peers as in-vivo models during game	+kickball game as stimuli +peer response as natural contingency +train loosely: opportunity to compliment during kickball game	•increase in percentage of verbal compliments out of five given opportunities •little to no increase in gestures •large increase in response variation and use of unscripted compliments
Plavnick et al., 2015	14, 14, and 17 years old	•three domains of behaviors that include verbal and nonverbal components (e.g., social attention domain: looks at peer, obtains attention, points at or holds up object, says "check out my drawing")	•peers as models in VM and in-vivo	+multiple exemplars: total of eighteen VMs -three contrived opportunities to emit each behavior per session	•rapid increase in percentage of target behaviors in trials and probes for three of the four students •small amount of generalization to novel setting
Radley et al., 2014	10, 11 and 14 years old	•four skills of participation, conversation, perspective taking, and problem solving requiring both verbal and nonverbal skills (e.g., orient body toward speaker, initiate and sustain eye contact, wait for turn, make comment or ask a relevant question)	•peers as models in VMs •peers as activity partners in role plays	+multiple exemplars: 3 VMs of peers per behavior +self-monitoring as mediator	•increase in percentage of correct steps to 100%, large effect sizes •setting generalization

Table 2, cont.

Study	Age of Participants	Complex Social Interaction Skill	Role of Peers	Efforts to Program for Generalization	Unscripted Outcomes or Generalization
Reeve et al., 2007	5 and 6 years old	•helping responses, including discriminating when help is needed, verbal offer to help, nonverbal motor imitative action	•peers observed to identify normative helping behavior •peers as models in VM	-number of VMs unclear +common stimuli such as toys, puzzles, books, desk +/-multiple exemplars, 32 structured trials with varied contrived opportunities to help or discriminating when help is not needed per session	•increase in percentage of correct response to 100% •generalization across materials, settings, and people
Scattone, 2008	9 years old	•verbal initiations, smiling, and eye contact	•peers as activity partners in generalization probes only	NA	•increase in percentage intervals with eye contact and verbal initiations •no generalization data reported

Note. +=strategies known to increase generalization, - = strategies that may limit generalization (Stokes & Osney, 1989)

Table 3: Definitions of Modeled Gestures

Gesture Name	Number of Times Modeled	Description
Awesome	9 times in 4 VMs	Make fist pointed up and pump once
Cool	8 times in 4 VMs	Make fist with thumb(s) up, with either one hand or two
Wave	8 times in 3 VMs	Open palm facing other person, raised, shake right and left several times
Tasty	5 times in 3 VMs	Palms together, rub up and down several times
No, Thanks	2 times in 2 VMs	Two hands up, palms facing out
Good Thinking	1 time in 1 VM	Point to head
Offer to You	2 time in 2 VM	One hand, palm up, moving toward person or object
Hot	1 time in 1 VM	Fanning face with one hand
I Don't Care	1 time in 1 VM	Hand open facing self, sweep fingers out or down
Right Here or This one	1 time in 1 VM	Index finger pointing at paper or picture

Table 4: Descriptions of Study Phases

Name	Description	Number of Sessions
Activity Selection	Teri, her mom, the peers, and a teacher identified age-appropriate activities that would elicit conversation	5
Baseline	Teri and Sonia were greeted, directed to collage activity for eight minutes with no prompts or reinforcement for conversation	4
Video Model 1: Activity-Specific Conversation	• Video production for activity-specific conversation VM • Post-video-production probe • Introduction of VM intervention: Teri and Sonia view two activity-specific conversation VMs prior to eight-minute collage activity	5 1 5
Video Model 2: Activity-Specific and General Conversation	• Video production for general conversation VM • Post-video-production probe • Introduction of VM intervention: Teri and Sonia view two VMs (one of activity-specific conversation, one of general conversation) prior to eight-minute collage activity	3 1 9
Video Model 3: Gesture-Enhanced Conversation	• Video production for gesture-enhanced conversation VMs • Post-video-production probe • Introduction of VM intervention: Teri and Sonia view two VMs (one of gesture-enhanced activity-specific conversation, one of gesture-enhanced general conversation) prior to eight-minute collage activity	1 1 6
Fading	• Teri and Sonia view one VM chosen by Teri prior to eight-minute collage activity • Teri and Sonia complete eight-minute collage activity without viewing any VMs	1 1
Generalization Probes	Teri and one of the peers eat lunch together at local restaurant or nearby lounge area and eight-minutes of conversation is recorded, no viewing of VM	4
Maintenance	Ten-week probe of conversation during eight-minute collage activity at public library, no viewing of VMs	1
TOTAL		47

Table 5: Activity-Specific Conversation Script and Gestures, Written by Melina

Conversant	Scripted Words [Gestures]	Number of Words	Initiations and/or Responses
Peer	Hi, Teri. [Wave gesture]	2	I
Participant	Hi, Melina. [Wave gesture]. How are you?	5	R, I
Peer	I'm good. Thanks for asking. Do you want to make a collage? [Offer gesture]	12	R, I, I
Participant	Sure! What color should we look for today?	8	R, I
Peer	I don't care [I don't care gesture]. What do you think?	7	R, I
Participant	How about yellow?	3	R
Peer	Cool! [Cool gesture] Let's look in the magazines to find some good pictures. Oooh! Look at this one. Do you like it?	20	R, I, I, I, I
Participant	Yeah. It's so pretty. You always find the best pictures.	10	R, I, I
Peer	Thanks. Should we glue it down now or wait?	9	R, I
Participant	Now. But where should it go? How about right here? [Points]	10	R, I, I
Peer	Awesome! [Awesome gesture] Go ahead and glue it down. Should we look for more pictures?	8	R, I, I

Table 5,
cont.

Conversant	Scripted Words [Gestures]	Number of Words	Initiations and/or Responses
Participant	Sure. Oh, look at this pretty flower. It looks really cool [Cool gesture]	11	R, I, I
Peer	Yes! That will be perfect. It makes me think of spring.	11	R, I, I
Participant	Or summer I'm going to put it right here next to your picture.	13	I, I
Peer	Looks great. You're so good at this.	7	R, I
Participant	Thanks, Melina. So are you. Do you think we are almost done?	12	R, I, I
Peer	Just about. Let me add one more. How does it look?	11	R, I, I
Participant	It looks so cool [Cool gesture] Yay! I think this one is done. Let's make another one tomorrow.	16	R, I, I, I
Peer	You bet. We make a good team	7	R, I
Participant	We make a great team [High five gesture]	5	R
Total Peer		94 words	17 Initiations 9 Responses
Total Participant		93 words	17 Initiations 9 Responses

Table 6: General Conversation Script and Gestures, Written by Marlo and Susannah

Conversant	Scripted Words [Modeled Gestures]	Number of Words	Initiations and/or Responses
Peer	Hey, Teri [Wave gesture]	2	I
Participant	Hi, Susannah. Your hair looks really pretty today.	8	R, I
Peer	Thanks, Teri. You are so sweet. How was your weekend?	10	R, I, I
Participant	It was awesome. [Awesome gesture] I went to the playground to swing. It was so nice outside.	15	R, I, I
Peer	Sounds fun. I love spring. It's warm but not too hot [Hot gesture] And there are flowers everywhere.	16	R, I, I, I
Participant	Yes. And the birds sing when I wait for the bus. What did you do this weekend?	17	R, I, I
Peer	I did some baking with my mom. Then I saw a movie with my friends.	15	R, I
Participant	That sounds cool [Cool gesture] What movie did you see?	8	R, I
Peer	*Inside Out*. It was really awesome [Awesome gesture]	6	R, I
Participant	Wow. I'll go see it with Hannah.	7	R, I
Peer	Cool. Is she done with her classes at Hawkeye?	9	R, I

Table 6 cont.

Conversant	Scripted Words [Gestures]	Number of Words	Initiations and/or Responses
Participant	Yes. I'm happy we can spend more time together.	9	R, I
Peer	That's awesome! [Awesome gesture] Family comes first.	5	R, I
Participant	So true. I'm getting hungry. What is for lunch?	9	R, I, I
Peer	I hope it is spaghetti. That's my favorite.	8	R, I
Participant	I think it is chicken nuggets. Tasty! [Tasty gesture]	7	I, I
Peer	Darn. I brought some of the cookies I baked with my mom. Do you want to try them? I think they're pretty tasty. [Tasty gesture]	23	R, I, I, I
Participant	I'd love to. Thanks, Susannah. You are the best.	8	R, I, I
Peer Total		94 words	14 Initiations 8 Responses
Participant Total		88 words	14 Initiations 8 Responses

Table 7: Teri's Mean Activity-Specific Words, General Words, and Gestures by Phase

Phase of Study	Mean Activity-Specific Words	Mean General Words	Mean Gestures
Baseline	11.25	4.75	1.75
Post-Video-Production Probe	28	14	4
Video Model 1: Activity-Specific Conversation	36.60	13.00	3.20
Post-Video-Production Probe	23	5	1
Video Model 2: Activity-Specific and General Conversation	22.44	29.44	1.44
Post-Video-Production Probe	24	14	2
Video Model 3: Gesture-enhanced Conversation	25.67	28.17	5.50
Fading of VMs	38.5	40.50	2.20
Generalization Probes	19.25	59.25	9.25
Ten-week Follow Up	17.00	37.00	5.50

Table 8: Mean Unique Total, Unscripted, and Scripted Words by Phase

Phase of Study	Mean Total Unique Words	Mean Unique Unscripted Words	Mean Unique Scripted Words
Baseline	14.60	14.60	NA
Video Model 1: Activity-Specific Conversation	31.20	19.60	11.00
Video Model 2: Activity-Specific and General Conversation	34.33	22.78	11.55
Video Model 3: Gesture-enhanced Conversation	36.50	21.83	14.67
Fading of VMs	52.00	33.50	18.50
Generalization Probes	45.00	23.25	19.25
Ten-week Follow Up	26.00	16.00	10.00

Note: Post-video production probes are not included in means above except for the first probe, which is included in baseline.

Table 9: Teri's Mean Number of Initiations and Responses by Phase

Phase of Study	Mean Number of Initiations	Mean Number of Responses
Baseline	8.40	9.60
Video Model 1: Intervention on Activity-Specific Conversation	19.60	13.60
Video Model 2: Intervention on Activity-Specific and General Conversation	11.67	25.44
Video Model 3: Intervention on Gesture-enhanced Conversation	10.50	28.17
Fading of VMs	19.50	39.50
Generalization Probes	13.25	45.50
Ten-week Follow Up	10.00	30.00

Note: Post-video production probes not included in means above except for the first probe

Table 10: Social Validity Means and Standard Deviations, Educators

	Pre		Post	
Question	M	SD	M	SD
1. The student with autism shows interest in the conversation.	2.50	.756	4.13	.354
2. The student with autism shows interest in the activity	3.13	.641	4.38	.518
3. The student with autism participates well in the conversation.	2.63	.744	4.38	.518
4. The student with autism appears to enjoy the conversation.	2.63	.916	4.13	.354
5. The peer shows good skill in drawing out conversation.	2.50	.535	4.50	.535
6. The peer and the student with autism seem like they know each other well.	2.50	.535	4.50	.535
7. There is balanced participation in the conversation.	1.63	.518	3.88	.354

Note: Scale is 1=strongly disagree, 5=strongly agree

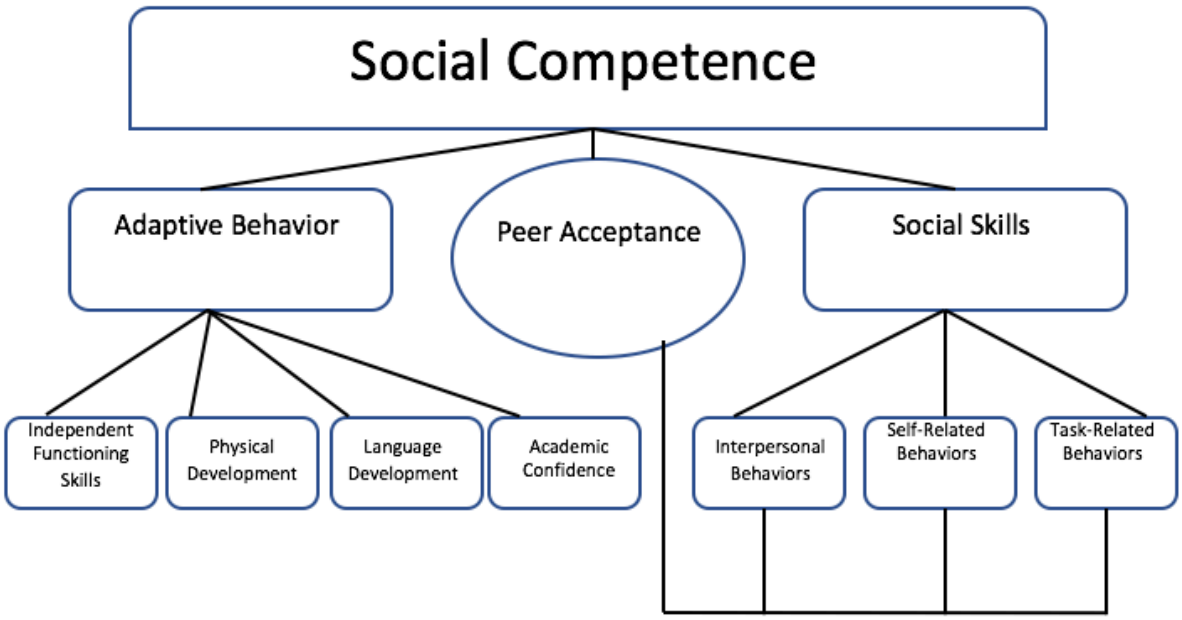

Figure 1. Working model of social competence. Reprinted from *Social Skills of Children and Adolescents: Conceptualization, Assessment, Treatment* (p. 14), by K. W. Merrell and G. A. Gimpel, Mahwah, NJ: Lawrence Erlbaum Associates. Copyright 1998 by Lawrence Erlbaum Associates, Inc. Reprinted with permission.

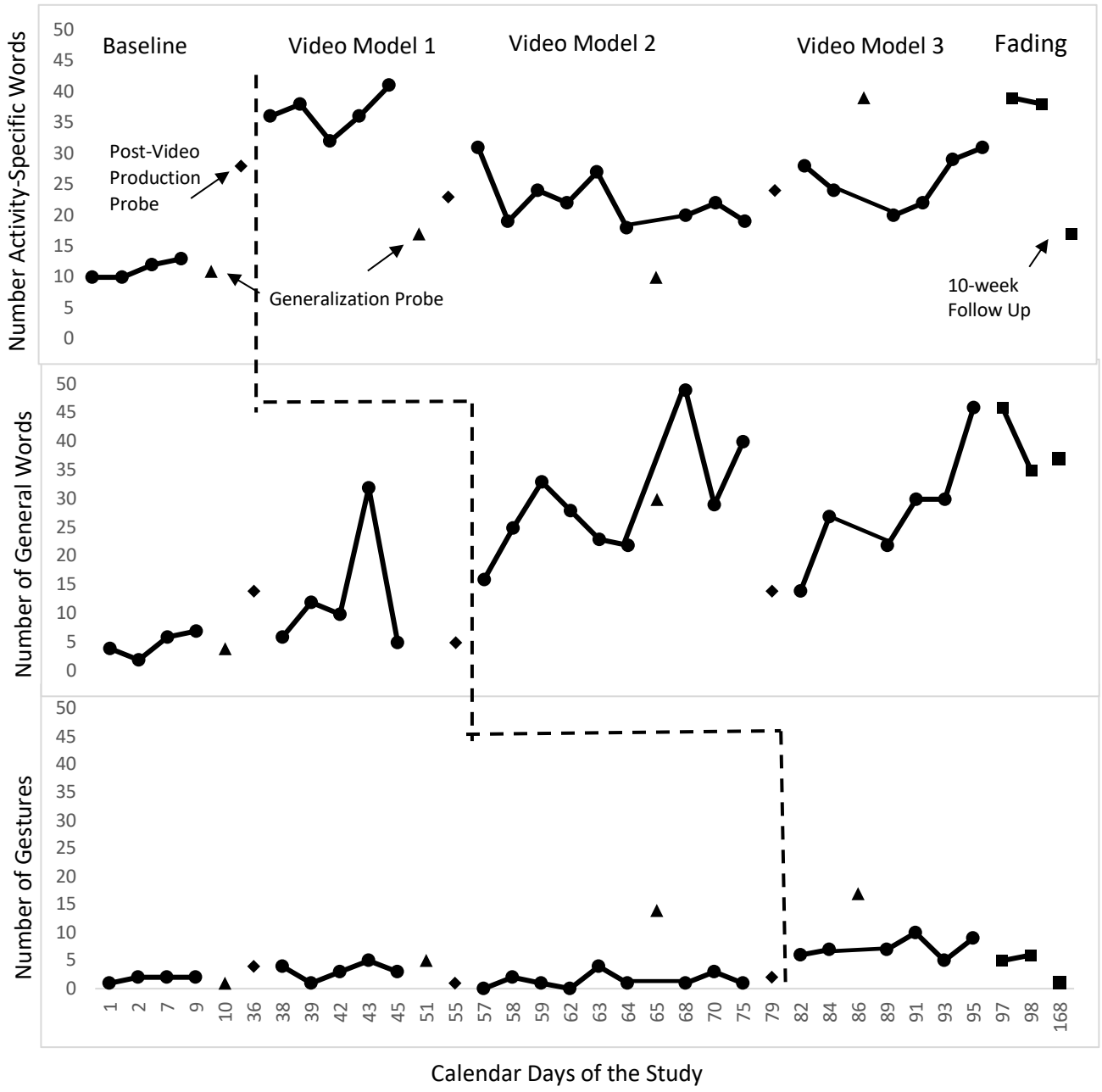

Figure 2. Teri's activity-specific, general, and gestural communication

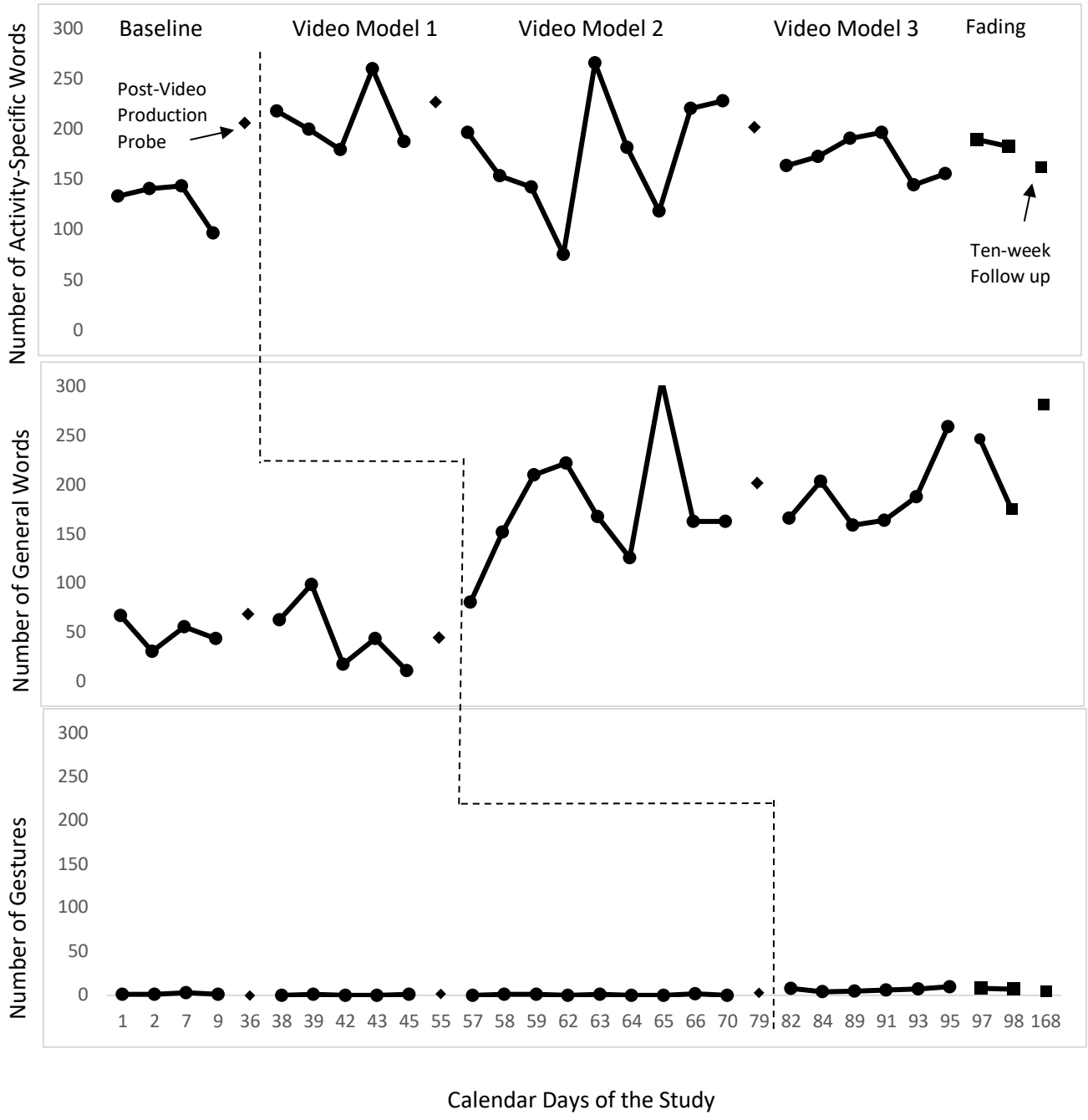

Figure 3. Peer Sonia's activity-specific, general, and gestural communication

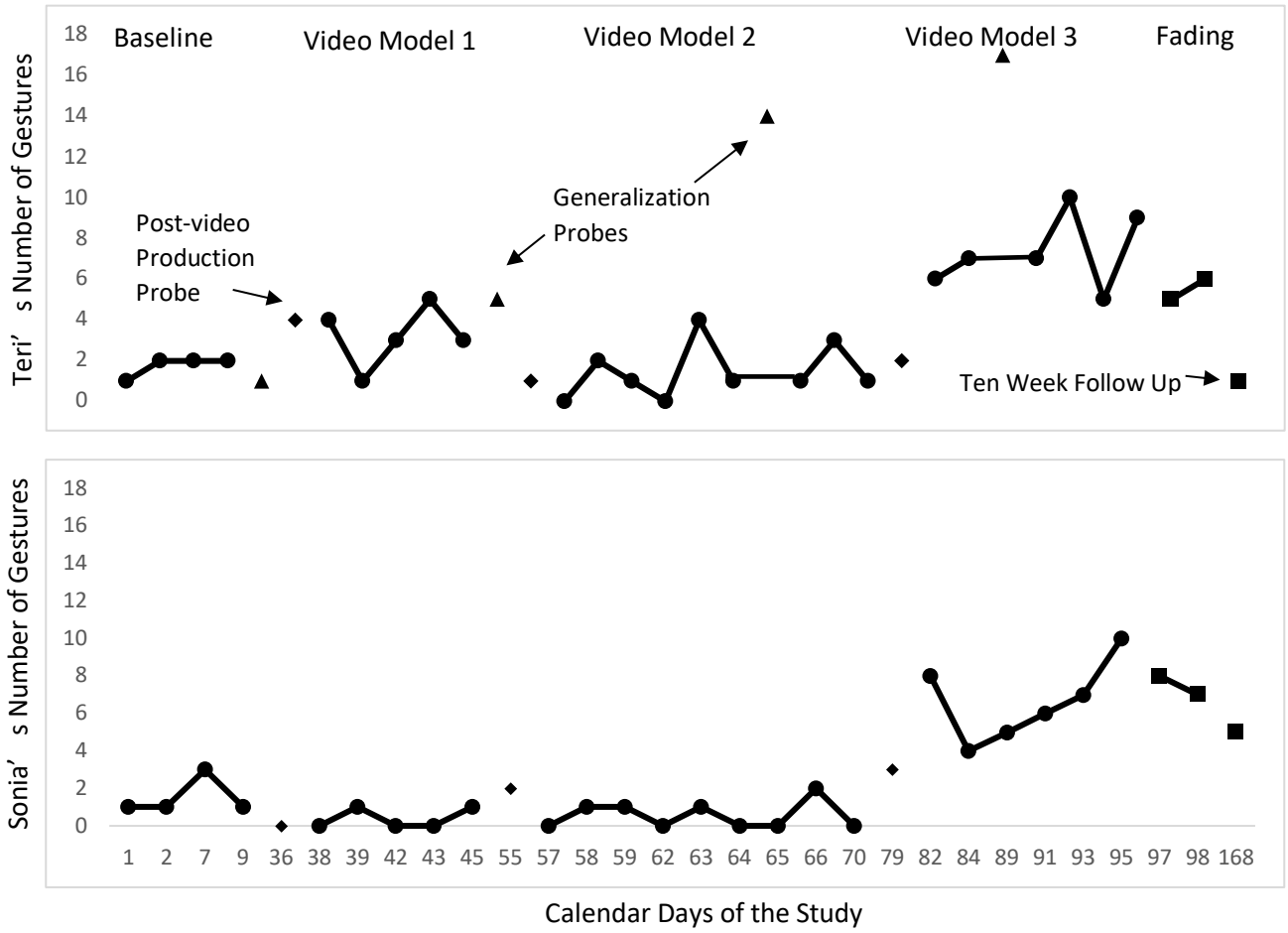

Figure 4. Teri and Sonia's number of gestures with adjusted axes

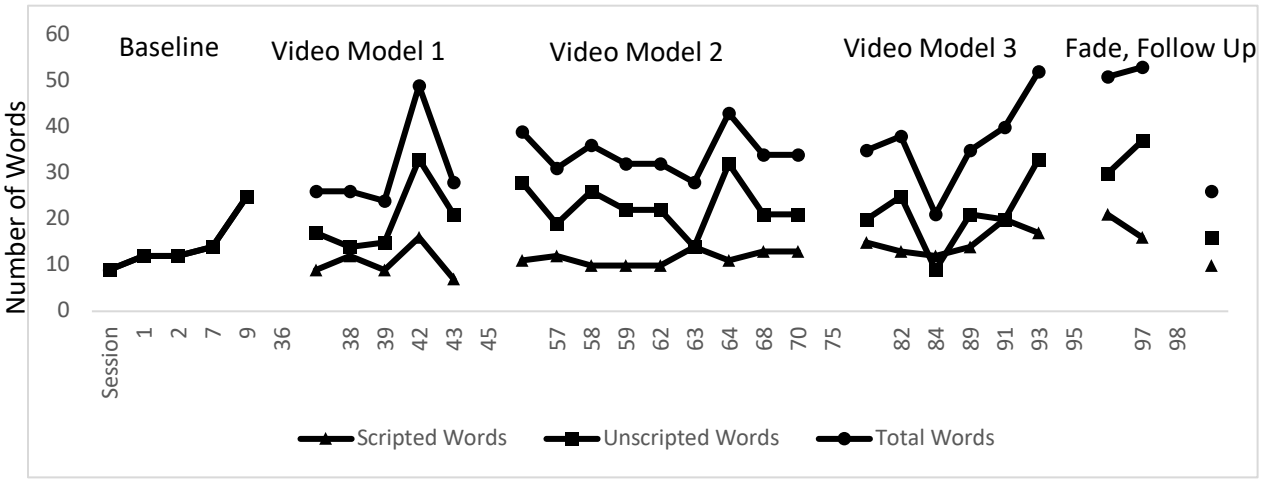

Figure 5. Number of unique total, scripted, and unscripted words for Teri

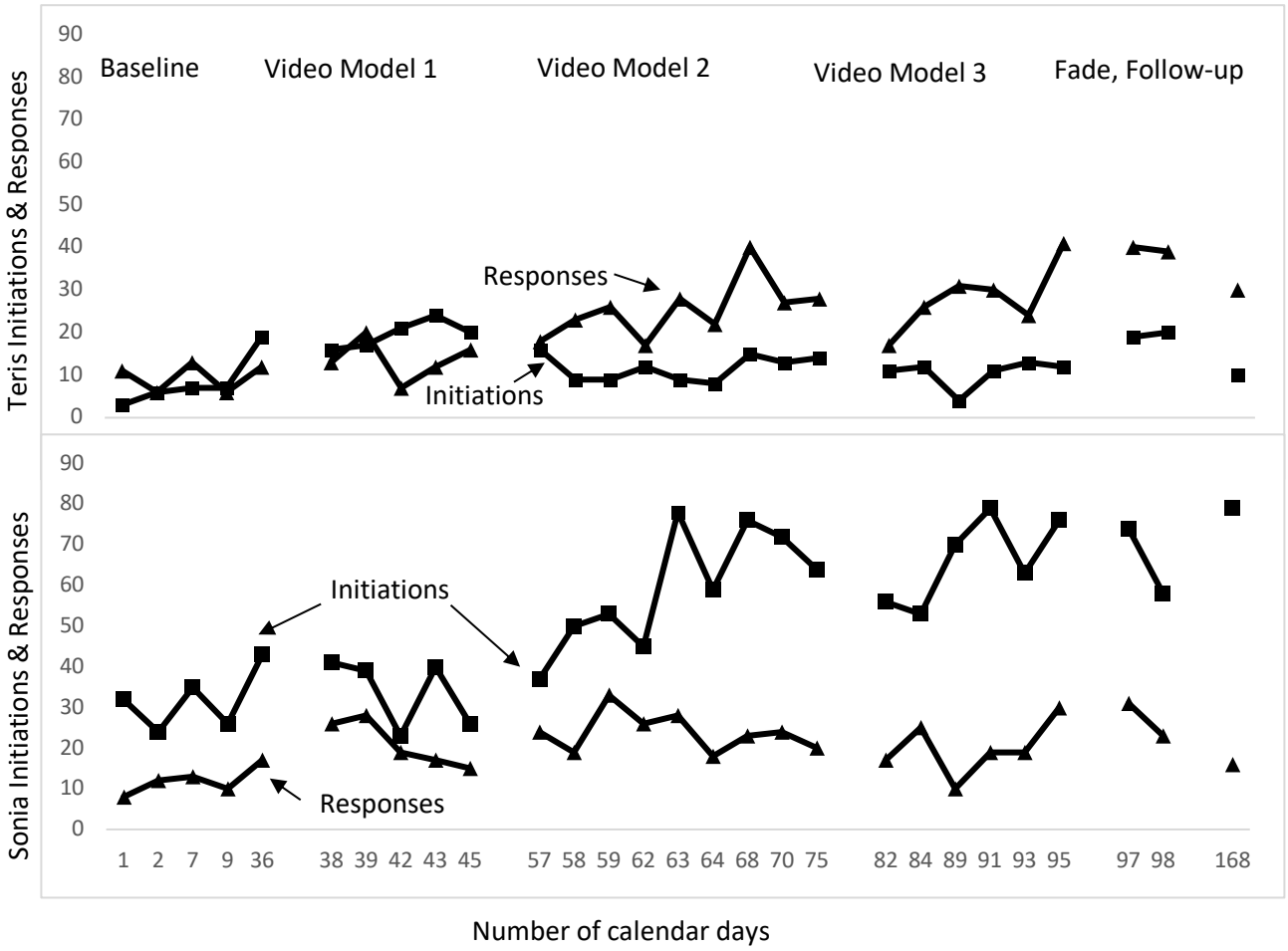

Figure 6. Number of initiations and responses for Teri and Sonia

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